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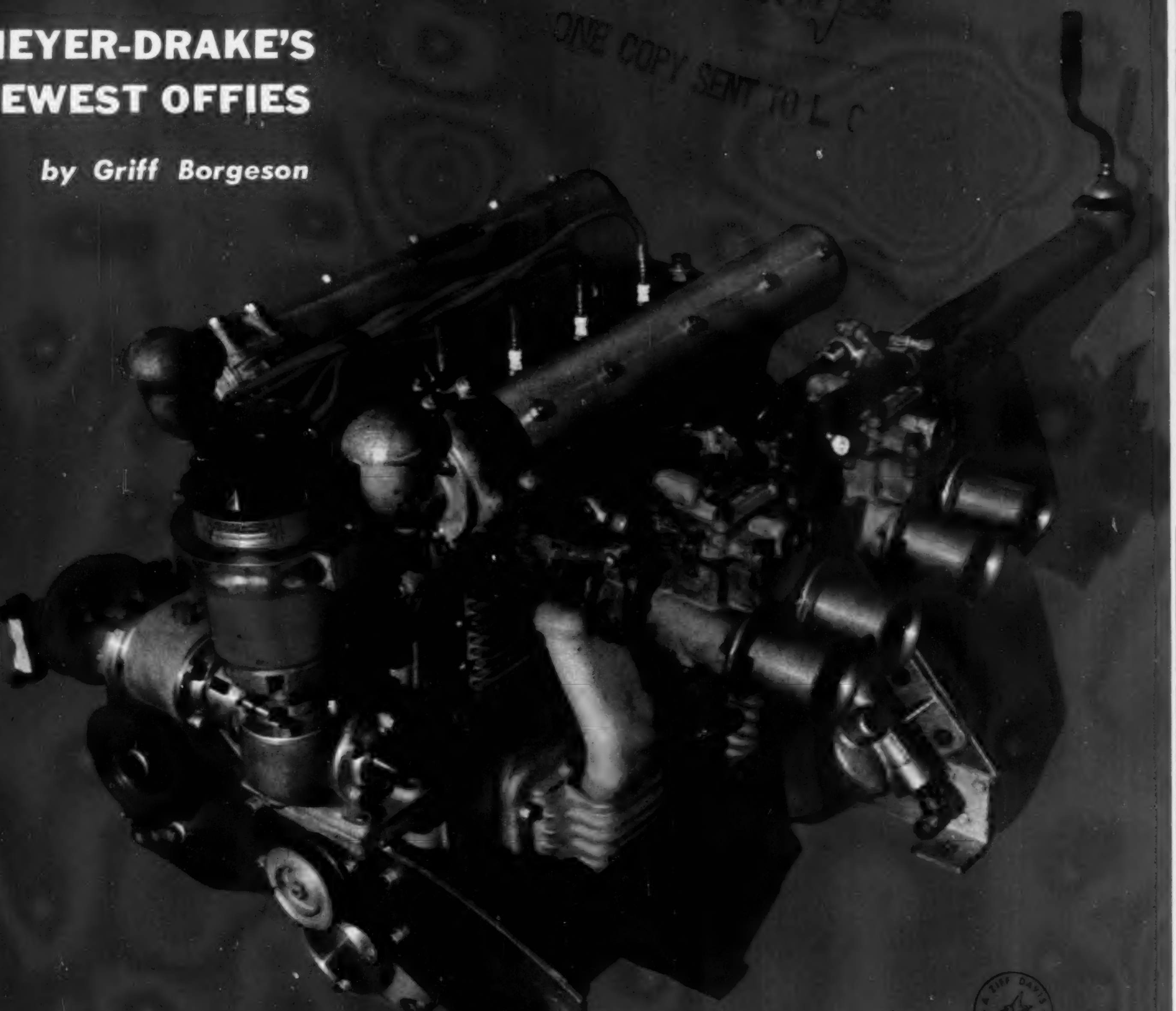
Special:

**MEYER-DRAKE'S NEWEST OFFIES**

*by Griff Borgeson*



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RACING FOR A DOLLAR A POUND See p. 22

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DKW

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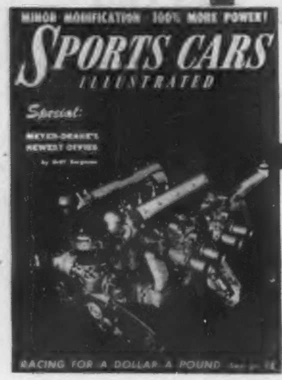


That heavily carbureted Offy on this month's cover is the latest in a long line of fast machinery. To see how it came about, turn to page 8. The mill was photographed by Bob Rolofson.



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# very sincerely yours

SOME months ago, the July issue to be exact, we ran two smallish stories giving details on how more power can be pulled from two different light cars, the Renault and the Volkswagen. The response to these stories has been fantastic and as a result, we are going to continue on a campaign to bring the word to the power-starved. One of the strongest objections to the current crop of light cars is that they don't pack enough suds to cope with modern traffic and the Detroit power-packers. Eminently maneuverable and economical though they may be, they haven't got the power to go with it, especially the earlier models.

This month (on page 38) we continue the series with a full and instructive article on power-packing the flathead Morris Minor. The Minor admittedly is no longer being made in flat-top form, having been fitted with a BMC rocker-box engine. But the country is literally stuffed with these earlier Morrises, which, in souped form, will eat the later ones alive, along with a lot of other respectable automobiles much larger than the mouse from Nuffield. Next month we'll come back to the VW and later go to various other light cars, including such ubiquitous equipment as the English Fords.

• • •

The light cars aren't the only ones that can use a bit of intelligent tuning, either. One of the tricks of the trade in introducing new automobiles is that of hanging anchors all over the new models so that improvements can be made from year to year, and Detroit is not alone in this. We, rebels that we are, feel that this is a deplorable situation for many buyers, and we hereby make a solemn promise that when such items hit the market, we will do our best to show how the best laid plans of factories can be made to go agley. To this effect, we have a dilly on the fire that should be of interest not only to buyers of the new car, but to those who would like to find a really nice Class D racing engine replete with all the latest refinements. A further hint is that this one can be done by intelligent digging in the manufacturer's parts bins, no recourse to special speed equipment being needed.

• • •

All of the above is not to say that we are advocating that every owner of every car go trotting out to the garage, tool box in hand, to bore, stroke, port and relieve. There are other ways to enjoy automobiles, too, and nobody realizes this more than the editors. Some of our readers are undoubtedly of a more academic bent and for these, we present for the first time in print, the complete geneology of America's greatest racing engine. Griff Borgeson, who by this time is the country's foremost Offy authority, has done a mountainous job of research to come up with the complete story of the latest Offenhauser engines and how they came to be. One of the surprising facts that comes to light is that *all* of the designing didn't emanate from Europe. The 50 through 59 series Bugattis owed a large debt of gratitude to Harry Miller, acknowledged godfather to the Offy. You'll find the full details on Page 8 and the Offy family tree on Page 12.

• • •

And then, of course, we must mention our exclusive cutaway feature again. This month it's what may very likely turn out to be America's hottest sports special, the fabulous Barnes-Trautman Ford. Take a look with Russ Kelly, starting on Page 32.

*— john christy*

# letters

### plug trouble

Dear Sir:

I have a problem. At 4000 miles my VW developed a high speed miss 48 to 55 mph. I replaced the Bosch plugs with Almquist H.C. Power Plugs. They worked okay until at 6200 miles I installed a Judson supercharger. The miss came back at 55 to 60 mph. I consulted Judson and they recommended Champion L-11-S plugs. They were okay for 100 miles, now I get the miss back at 65-70 mph. Do you have a solution?

Your advice will be most welcome.

Very sincerely yours,
Raymond Dunlap
Philadelphia, Pa.

*It looks as if you are in for the expense of a set of Lodge platinum-point plugs. These are about $3.80 or so apiece, but they do the job. Use the recommended heat range of the manufacturer for your car to prevent fouling. The platinum will prevent burning. You might also check with Lodge for advice. — Ed.*

### volkswagen service

Dear Sir:

Having recently finished reading your latest edition under new management and editorial direction, I have found your magazine to be exactly if not more than your Policy Statement in your April edition.

I am now presenting a problem which many others in my position are faced, loving sports car, but being able to afford the German VW.

Although maintenance is relatively no problem, I have been in somewhat of a futile search for material concerning mechanical data and detail servicing of my car. Having no response from the dealer from which I purchased my car, I have tried various book stores with no avail.

I would greatly appreciate any information which you or your staff might present to me as to available publications concerning the VW.

Sincerely,
PFC Donald J. Groshong
Camp Pendleton, California

*There is little, if any, independent literature on the VW. Even the authorized dealers have trouble getting service literature, it's so scarce. In view of this, we will be covering service data on the VW with some regularity. Some of this will concern straight servicing, some will concern modifications and modernization. Also we are in contact with the VW Owners' Club which passes on information as it is discovered. As a service to readers we will act as a clearing house for technical data on VW as well as other foreign cars and invite readers to pass on to us any and all service and modification data they might come across. — Ed.*

### new boy

Dear Sir:

I have just recently become interested in sports cars and in your fine magazine. I now own a Detroit model but hope by next summer I will be the proud owner of a really fine car, such as the Porsche. I very much enjoyed the article about my dream car in this month's magazine.

My friends and I have a little argument about exactly what it means when a car is called a 2 or 2.5 litre car. Would you kindly straighten us out on this.

Enclosed find my subscription and remittance for 18 months of your magazine.

Sincerely,
John H. Mayo AG2
US Navy
NAS, Norfolk, Va.

*The litre designation refers to the displacement of the engine in metric terms. A 2-litre car would have an engine with a swept volume of 2 litres or 2000 cubic centimeters, which in English measure is 121 cubic inches. — Ed.*

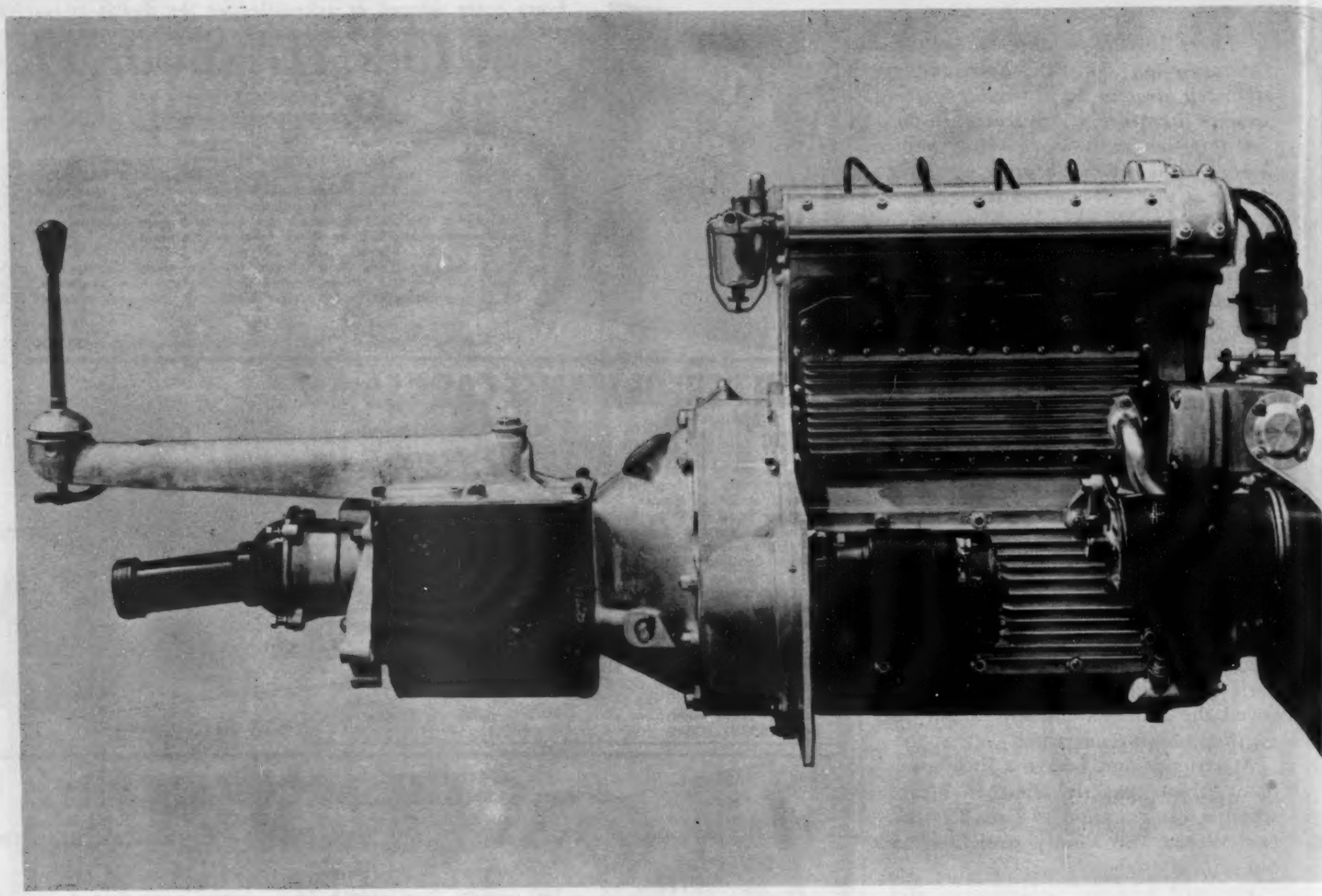
### cool jag

Dear Sir:

As a regular reader of your admirable journal, I noted with interest the letter from Dr. Walters headed "Hot Jag."

While your recommendations are in order, particularly in regard to the advancement of the ignition timing, there is one modification that should be carried out which I feel would obviate his troubles. The water pump impeller should be replaced with the new five bladed type. At the same time, make sure that there is not too much float between the impeller and the pump housing.

Your very truly,
Jack Parkhouse
Parkhouse Motors
Los Angeles, Calif.



*The 1500 Sports engine. Entire clutch housing and universal adapter are specially machined to fit MG TC gearbox.*

# AN AMERICAN THOROUGHBRED

Photos by Griff Borgeson

*Leon Duray and Norman Batton in two Miller 91's on the Packard test track. Duray averaged 148 mph for one hour here in 1927 setting an official AAA record.*

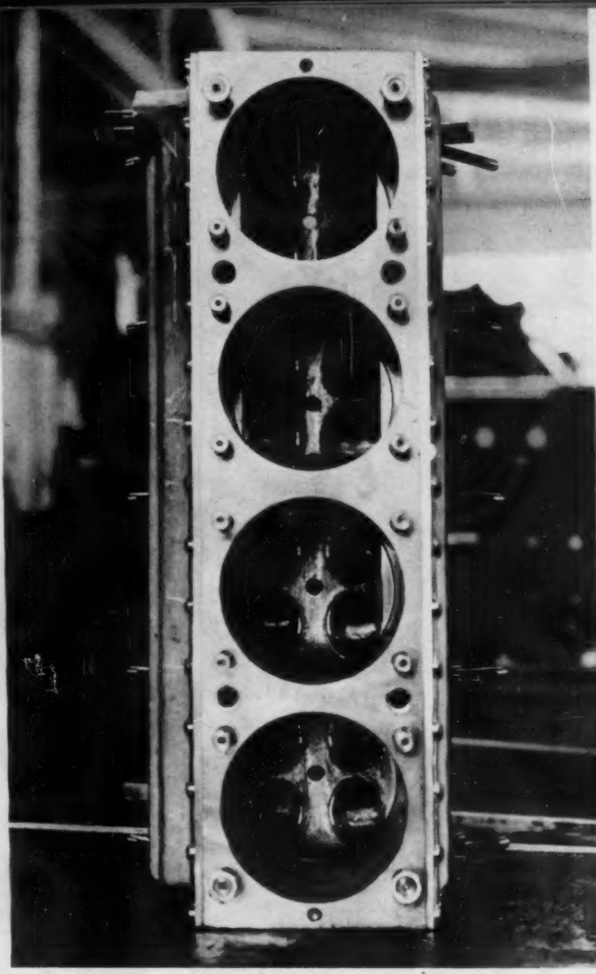
***Four new Offies are coming from Meyer & Drake two are already cleaning house on road courses and two others are soon to hit the championship circuits. Here is Griff Borgeson's report on the new thoroughbreds and how they came to be.***

BRIGGS CUNNINGHAM, a dedicated sportsman if one ever lived, spent years trying to conquer Le Mans with cast iron. With due respect for his efforts, many U.S. enthusiasts feel it's a national tragedy that the long costly experiment didn't begin with America's greatest thoroughbred engine instead of ending with it. Cunningham's new, gasoline-burning 180 cu. in. Offenhauser ran with tremendous promise at Le Mans last year until reportedly the synchro bronzes in its German gearbox wore out, and was forced to drive with transmission locked in high, which put an abnormal load on the engine and led to a burned piston. With that, Cunningham set down the torch he'd carried so long for the Made-in-U.S.A. label.

So far this is as close as the Offy has come to making a splash in big-time road racing. The reason is not that the light but lusty four-banger is short on performance or stamina. It's that few road-racing enthusiasts build a car around an engine, and when they do they almost invariably choose a cheap, mass-produced power plant that will keep costs down.

The price of a 270 cu. in. Offy is very close to that of a complete Mercedes-Benz 300SL. And you get a power plant developed to run on alcohol fuel. You still have to alter cams, pistons and induction system for gasoline, and the engineering, machining and testing cost more money. Even the recently-developed 91 cu. in. Sports Offy has been selling for something close to the price tag of a Jag XK140. Offy prices are perfectly justified, but it's not hard to see why specials builders aren't beating down the doors of Meyer & Drake's modest Los Angeles plant.

But in a quiet way — quiet largely because there are no commercial interests pounding the drum for Offy successes — a few believers in breeding, as opposed to brute brawn, have been finding out what these engines are able to do on road courses and on gasoline. George Beavis of Los Angeles, owner of the first of the four-cylinder 91's re-

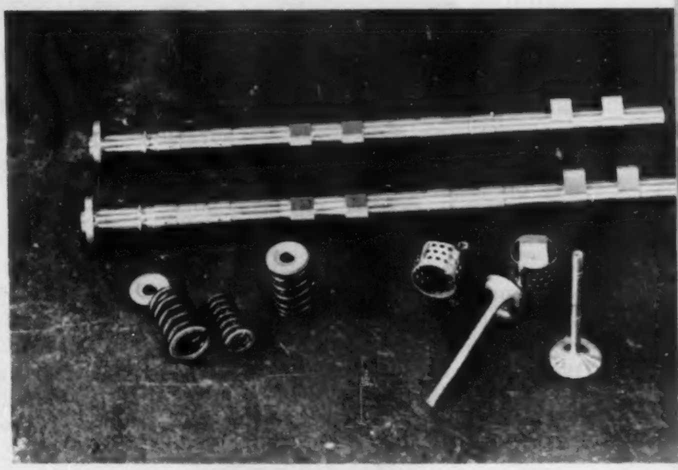


*Looking through cylinder barrels in a 270 block. This is how the pent roof chamber in the cylinder head appears. Note four valves per hole.*

# and HOW IT GREW

By GRIFF BORGESON

Photos by Wilson Photo

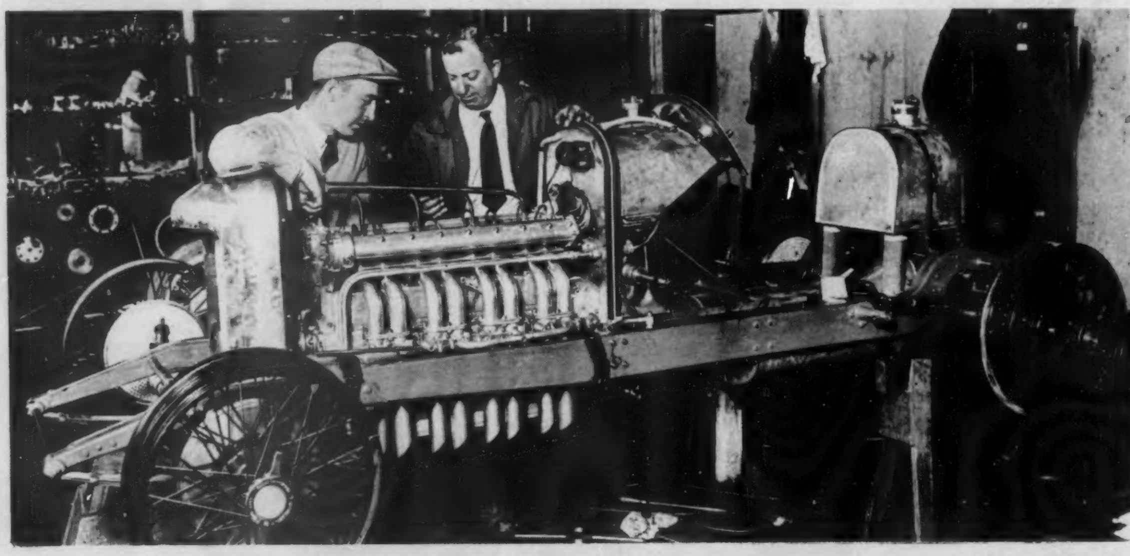



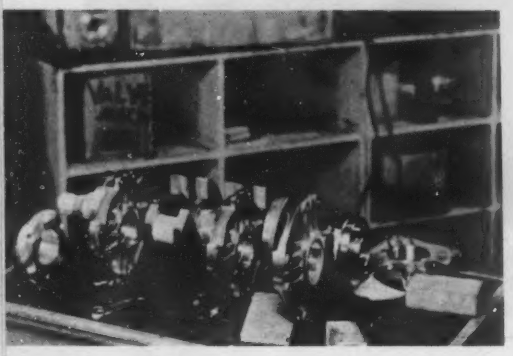
*Offy's twin cams are identical for double valve arrangement. Valves, springs, and cup-type followers which fit over springs, below cams.*

*This Miller 300 cubic inch four-holer of 1916 followed Henri Peugeot practice closely, but used only one camshaft.*

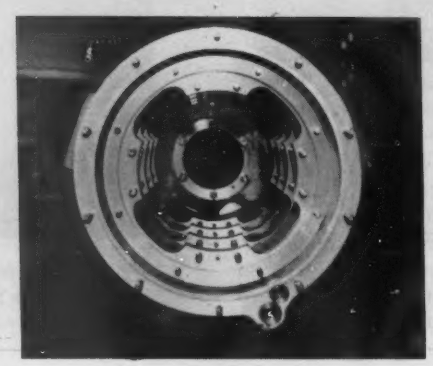
*Jimmy Murphy (left) and Harry Miller (right) discuss assembling the Miller 122 in 1923. Carburetion is reminiscent of current dual throat.*

**Photos by Art Streib**

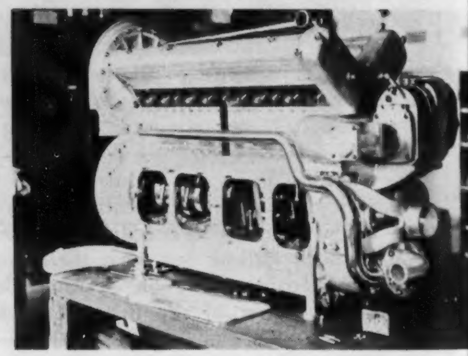




*Crankshaft and webs. These webs bolt to crankcase bulkhead giving 360 degree support to bearings.*



*Sighting into the Offy barrel-type case from the flywheel end. Mains except front are carried in bearing webs.*



*One of the first Miller blown 91's Engines produced uncanny power and speed outputs.*

leased by Meyer & Drake in 1953, is a one-man research institution dedicated to the development of the Sports Offy. He works closely with M & D, does his own mechanical work, builds his own chassis and bodies, races constantly. He and his Offy 91 have won the under-1500 modified class at Torrey Pines, Palm Springs, Santa Barbara, and have done it twice at Willow Springs. "I've worked with Offys for 16 years," Beavis says, "and I'm still sold on them. Their potential for road racing is just beginning to be guessed at."

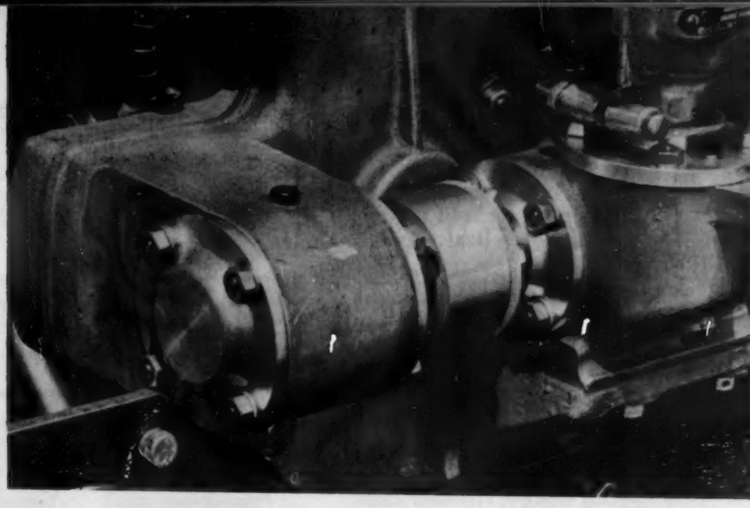
Beavis' faith in the Offy was nicely vindicated at Palm Springs in 1954. When he learned there was to be an event for competition cars of 2000 cc and under, he fitted the biggest crank and block he could get for his little Offy engine, bringing its displacement up to about 1750 cc. With this combination he easily won the two-liter race, almost lapping the second-place, bigger Ferrari Mondial.

Oil man Jack Hinkle of Wichita is another believer who wins races in his part of the world with his Offy 91 installed in a specially-designed Kurtis two-seater. There are a couple of other 91's on the coast: Dr. William Escherich's in an ex-Barlow Simca and writer Allen Le May's, in a Lotus. New combinations for getting the most out of these engines are being learned constantly. The success they eventually achieve will be mainly a function of the skilled man-hours (money, again) devoted to their development.

The "atmospheric" 180 Offy, a 1955 innovation, titillated many imaginations when Cunningham took it to Le Mans. Time for preparing – actually developing – the new engine was painfully short, yet Cunningham announced a dyno-yield of about 250 bhp before the race and the engine's performance during the event was encouraging to many and inspiring to quite a few. One of the encouraged or inspired ones is George Tilp of New Jersey who is inserting an Offy 180 in a Ferrari Mondial at this writing. It will be a car worth watching. This swap will be reported in a coming issue of SCI.

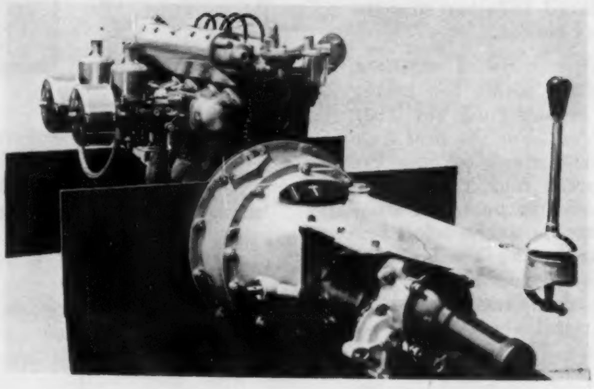
Just what are the odds in favor of the Offy winning a place as one of the world's better road-racing engines? One way of answering that is to judge this family of engines on the basis of past performances. In every field they have entered – midget, marine, dirt track and paved track – engines built in the Miller-Offy tradition have quickly established their domination. If they can do this where the requirement is "stand on it and turn left" it's hard to see why they should not do very well powering cars that also must turn to the right. And let no one tell you that the Offy is lacking in low-speed torque; its pulling power at low revs is one of its greatest virtues.

Another way of judging the Offy's promise as a road-racing engine is to consider its background. Is the design a flash in the pan or is it a product of great, sound, successful traditions? To answer that we present, for the first time in print, a graphic outline of Offy evolution.

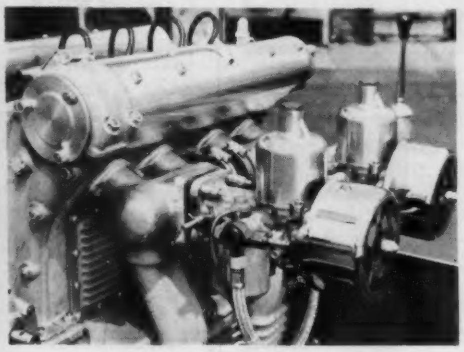


*Lucas distributor sets in place of magneto. Ignitor is driven by gear drive train to crankshaft.*

Photos by Bob Rolofson

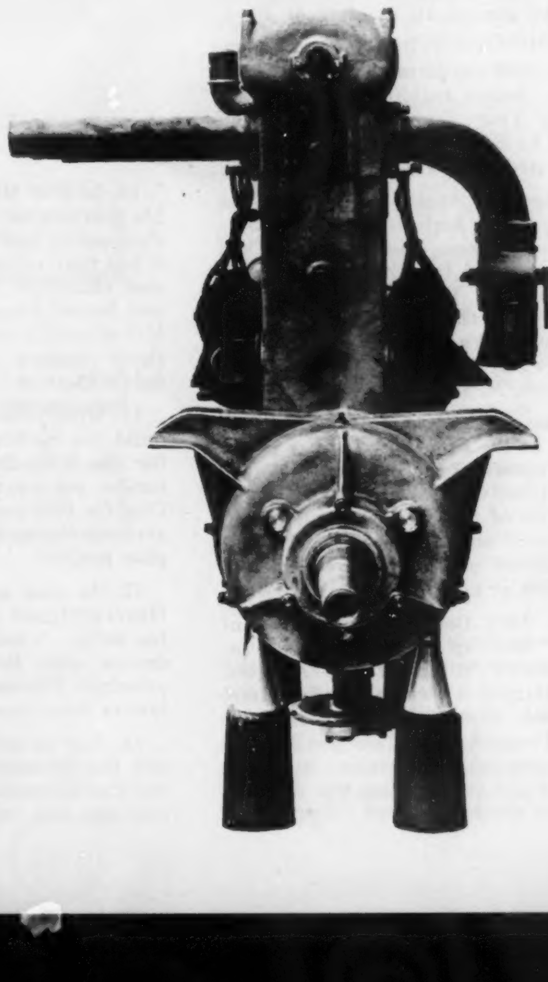


*RIGHT: Rear adapter for universal had to be specially made. Engine is mounted by flat stock to fit chassis.*



*Front view of the Miller 300 cu in of 1916. The block offset on the crankcase was an Henri Peugeot touch. Note straight through porting.*

*Intake is controlled by two side-draught SU carburetors bolted to a log-type manifold. Webers are optional.*



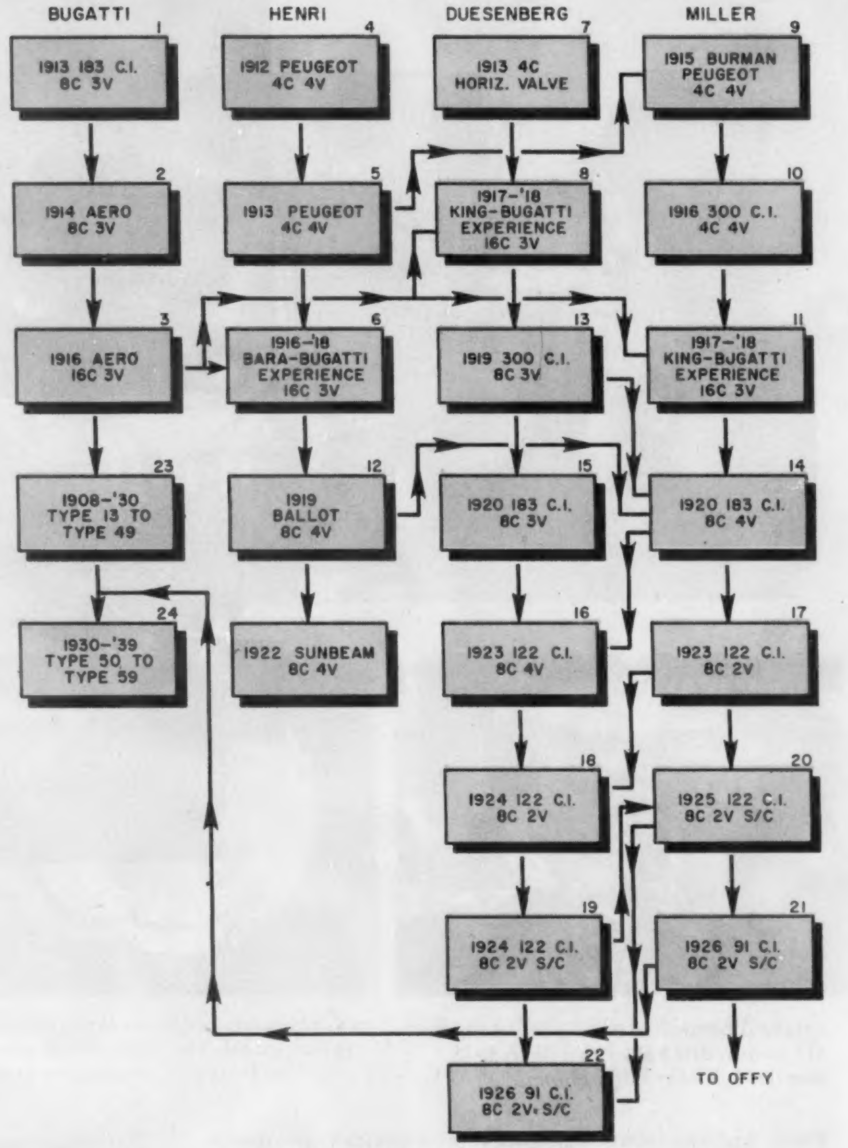
These are the main bloodlines of America's greatest racing engine. Its stamina and power stem from all the thoroughbred strains listed here and its present high degree of refinement is the result of four decades of the applied experience of literally hundreds of anonymous experts . . . talented practical engineers like Tommy Milton, Frank Lockhart and Jack McGrath. That the Offy's potential for road racing is untapped is absurd. To Americans who are investing in costly foreign iron, we'd like to recommend a homeward look. A racer with a pedigree full of champions is worth betting on.

As we go to press the Indianapolis Motor Speedway announces that competition in the 1957 500-mile race will be limited to cars with engines no larger than 255 cu. ins., or 164 cu. ins. supercharged. Unfortunately these reductions from the currently permissible 274 and 183 cu. ins. are too small to justify the redesign of existing engines—something the 270 admittedly could stand. Sleeving, new blocks or new crankshafts will suffice to bring present engines within the new Indianapolis formula.

However, there is a strong element among owners of Indianapolis machinery that sees this change as one step in a series that will bring the Indianapolis formula into exact agreement with the F.I.A. international formula in 1960. If this transpires a new, modern Offy certainly will be designed and produced. Meanwhile, the familiar four-banger will keep hammering away, doing its eternally effective job.

**Continued on following page →**

## CHART I – THE ROOTS




1. In 1913 Ettore Bugatti built a straight-eight engine, using two of his four-cylinder blocks on a common crankcase. A single overhead 57 camshaft operated three vertical valves in each cylinder.

2. This led to a 250 bhp straight-eight aircraft engine of similar layout. This was probably the first production in-line eight, and was made under license from Bugatti by Delaunay Belleville in France and Diatto in Italy.

3. This, in turn, led to an aircraft engine made up of two straight-eight blocks and crankshafts with a single crankcase. The vertical blocks were parallel to each other and the crankshafts were geared together like the rotors in a Roots blower.

4. Ernest Henri, a Swiss engineer, broke the existing molds for racing engines when he designed the 1912 grand prix Peugeot. For the first time he combined in a single engine the following features: four vee-inclined valves per cylinder in pent-roof combustion chambers; overhead camshafts; separate intake and exhaust camshafts. This engine had a split crankcase and the camshafts were driven by a vertical shaft and bevel gears.

5. For 1913, Henri improved this engine in many ways. Two important changes were the adoption of a barrel-type crankcase and camshaft drive by means of a train or tower of spur gears. The design was so successful that within a year it was being imitated by almost all builders of European racing engines.

6. In 1916 the Bara Cie. of Levallois, France, began building item #3, the Bugatti Twin Eight. Henri was employed by Bara and was exposed there to the straight-eight concept.

7. Fred and August Duesenberg had been building high-performance four-cylinder engines. Some of these had two, some had four horizontal valves per cylinder. The Duesenbergs contracted with the American Can Company to build a production car around their engine at that firm's plant at Elizabeth, N. J.

8. The Bugatti 16 was built under license at the same New Jersey plant. It was known in the U. S. as the King-Bugatti, for Charles B. King, engineer in charge of the project. The Duesenbergs were not active, official participants in the project but were able to observe it at first hand.

9. In 1915 Bob Burman, "King of Speed," blew up his 1913 Peugeot engine. Harry Miller of Los Angeles, manufacturer of racing carburetors, undertook to reconstruct practically all the Peugeot parts. This was Miller's first engine job. The machine work and much of the engineering was done by his chief mechanic, Fred Offenhauser.

10. In 1916 Miller designed and built his first engine from scratch. Like the Peugeot he had come to know so well it had four valves per cylinder in pent-roof chambers, gear-tower cam drive, and barrel crankcase. For simplicity, Miller used a single camshaft. One of these engines powered Barney Oldfield's historic Golden Submarine.

11. Miller was awarded a contract to build the carburetors and fuel pumps for the King-Bugatti. He and Offenhauser set up a plant in New York City for this purpose and participated actively in the twin-eight aircraft engine project.

12. As soon as World War I ended, Henri designed a 300 cu. in. racing car for Ballot. It combined Henri-Peugeot design with Bugatti's straight-eight principle. Piston or cup-type cam followers were used in the Ballot engine.

13. Just as quickly after the Armistice the Duesenbergs left the American Can Company and designed a new race car. The engine was highly original but reflected strong Bugatti influence. It, too, was a straight-eight with a single camshaft. However, its three valves per cylinder were slightly inclined and the cylinder heads were detachable. The long crankshaft ran in only three main bearings in a barrel case; cam drive was by shaft and bevel gears.

14. In 1920 Miller, who had just added engineer Leo Goossen to his team, built his first straight-eight. It reflected Peugeot, Bugatti, Ballot, and Duesenberg influence. The Miller 183 had four valves per cylinder in pent-roof chambers, actuated by dual overhead camshafts driven by a gear tower. It used a three main-bearing crank in a barrel-type case. Fred Offenhauser got the idea for the cup-type cam followers when he sneaked a peek under the cam covers of Ralph de Palma's Ballot. The Miller 183 inaugurated the series of engines that produced the Offy.

15. Duesenberg's engine for the 183

# Growth of the Thoroughbred

cu. in. formula was a scaled-down 300. It perpetuated some weak points of design, including detachable cylinder heads and Y-shaped rocker arms that were prone to break.

16. Duesenberg's first engines for the 122 cu. in. formula used a top-end design evidently inspired by the Miller 183, with four valves per cylinder, dual overhead cams and gear tower drive. The three main bearings and detachable cylinder heads were retained.

17. But Miller's engines for this formula had a very new top end. They featured two valves per cylinder in combustion chambers that were, perhaps for the first time, truly hemispherical, rather than prism-shaped. And Miller made the wise change to five main bearings.

18. Duesenberg, thanks to the convenience of detachable heads, entered the 1924 122 cu. in. season with both two-valve and four-valve heads, both of obvious Miller inspiration.

19. One of the great "scoops" of racing history was when Duesenberg sprang the centrifugal supercharger at Indianapolis in 1924 and walked away with the race. Dr. Sanford Moss of General Electric Corp. was credited for design and development of the blower.

20. The Miller team instantly plunged into supercharger research and by early 1925 all Miller 122's were blown.

21. For the 91-inch supercharged formula that began in 1926 Miller engines were essentially scaled-down 122's.

22. Duesenberg's 91 was now very similar to the Miller pattern. Duesie finally adopted a five-bearing crankshaft and integral cylinder heads.

23. During all these years, Bugatti had continued to use three and, rarely, four vertical valves per cylinder in blocks with integral heads. In 1929 Leon Duray took two Miller 91's to Monza, blew one of them up while leading the race, swapped both cars with Ettore Bugatti for three of the latter's touring machines.

24. In 1930 Bugatti introduced his Type 50, with an engine that was traditional except for its top end, generally regarded as having been Miller-inspired. However, Bugatti continued to use finger-type cam followers instead of cups. This layout was perpetuated on all subsequent Bugatti models.

25. The evolution of the Offy family of engines now can be seen clearly. Distinct forerunner of the classic Offy midget was the engine with which Harry Hartz won the 1932 Indianapolis race. It was basically a Miller 91 without supercharger and with bore and stroke blown up to give doubled displacement.

26. The 97 cu. in. midget of 1934 was essentially the Hartz 183 cut in half.

27. The 91-inch Sports Offy was a slightly modified Offy midget.

28. Miller's line of marine racing engines began in 1926, when Gar Wood commissioned a 310 cu. in. power plant for Junior Gold Cup and 340 Hydroplane competition. This was basically a scaled-up Miller 122.

29, 30. For racing in the 151 cu. in. Hydroplane class, Miller cut the 310 in half. For Gold Cup racing he multiplied the 310 by two, making it a V16, still with barrel crankcase.

31. For 91-cu. in. hydroplane competition the track-racing 91 was directly converted to marine use.

32. Car owner and race promoter Bill White had confidence in the low-speed torque of a good four-cylinder engine. He and Miller's team converted a marine 151 to track use, increasing its displacement to 183 cu. ins. At Indianapolis in 1930 this Offy four-banger came within an ace of winning, held second place all the way.

33. With this encouragement, a 200-cu. in. four was designed from scratch for track racing.

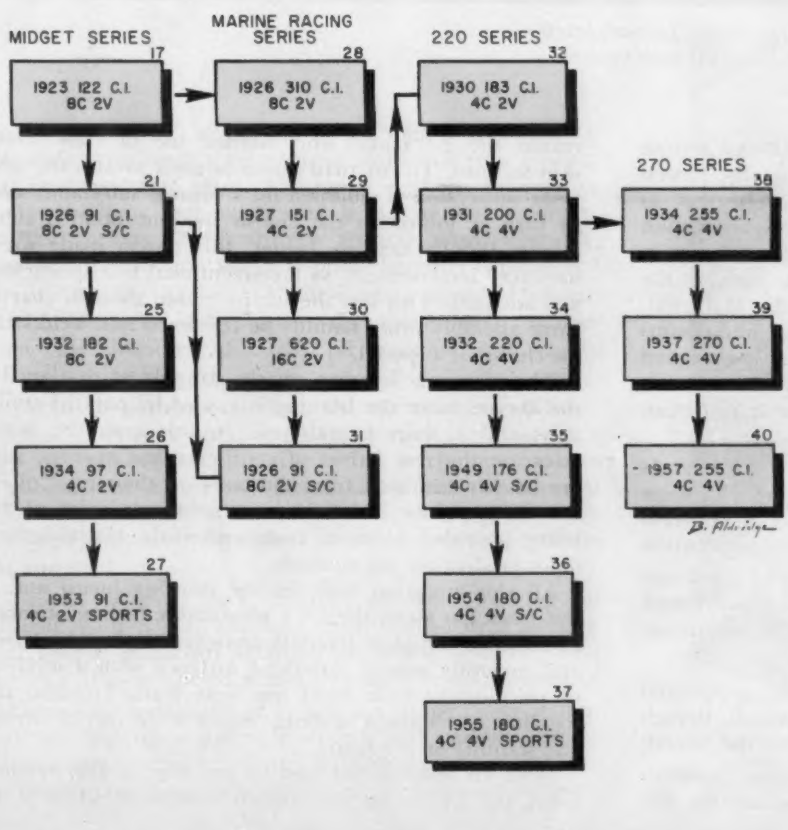
34. The 200 was enlarged to 220 in 1932. In 1948 the 220 was given the big 270 Offy's huskier crankshaft. The 220 still is absolutely unchallenged in dirt-track racing.

35, 36. Out of the 220 were derived the 176 and 180 blown engines of recent years. These are potentially capable of leaving the unblown 270 in their dust. Again, money is needed for their development.

37. Out of the above came the unblown 180 which, with very little development, was run by Cunningham at Le Mans in '55. Its potential is excellent; it's a stronger, smoother engine than the 270 which, if anything, is over-developed.

38. In 1934 Fred Offenhauser, who had taken over the company, was asked for an engine to beat the 220. He scaled up the 200 to 255 cu. ins.

39. In 1937 this engine was enlarged to become the 270, rarely-challenged ruler of big-time professional racing in the U. S. ≠



# SCI ROAD TEST:

# *Two point four* Jaguar

*Two-point-four rolls to the side going around test curve. Jaguar's latest export is more a sports family car than a sports or sports touring car.*

IT'S NOT often that the sports car clan takes a serious interest in the latest four-door sedans. but the newest Jaguar "saloon" has caused a lot of excitement in those quarters. Part of it is the result of Jaguar's reputation as a builder of sports cars, which promises good things in the performance and handling departments. Also, as the first major new model from Coventry since the Mark VII, the 2.4 reveals a lot of advanced thinking and points strongly toward Jag's future sports car plans. It intrigued us, anyway, so in search of a dual personality we took over a pastel blue machine from Jaguar Cars North American for a few days' testing.

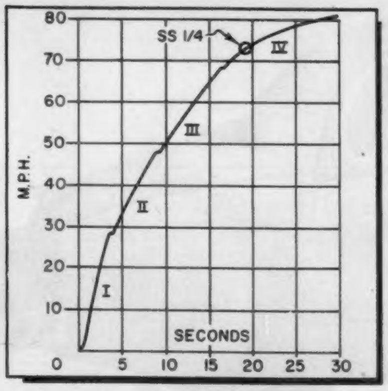
Following a reliable model change plan, the 2.4 emerges as a tastefully balanced blend of tried principles with some of the unusual techniques learned in six years of Le Mans competition. The biggest switch from English convention is the use of integral chassis-body construction on a car of this size, which brought advantages of its own and forced complete reconsideration of a lot of suspension and silencing problems.

As in most early ventures in integration, a vestigial frame still angles beneath the stressed floorboards, though the boxed sills and cowl add a great deal to the overall strength. Tightly stretched panels act like drum heads in picking up and broadcasting small vibrations, and for this reason the 2.4 makes only limited use of fully stressed skin sections. To cut road noises at their source, the whole front suspension is mounted on a pressed sub-frame, which in turn is joined to the chassis by four bonded rubber blocks. Wholly new to Jaguar, this system made torsion bars very inconvenient, so a conventional coil spring setup was adopted. This has the happy result, though, that this front assembly could handily be lightened and welded into the chassis of a special.

The rear axle location smacks strongly of that used on the D-type, since the housing is guided by parallel trailing arms and a short lateral arm. In this case, the bottom arms are the rear halves of cantilever leaf springs, which are heavily insulated from the body on their total of four mounting points. There is, in other words, a lot of flexibility provided at both ends, and little resemblance to older production Jag methods.

All this attention both on the drawing board and the test track has given the 2.4 a remarkable feeling of solidity and almost complete freedom from rattles. It rides silently and smoothly over a variety of surfaces, with a minimum of pitching in both front and rear seats. Freedom from joggling is obtained without losing a degree of firmness and stability on the road.

With an anti-roll bar and 57 per cent of the weight in front, the 2.4 can be expected to understeer, which it does




From the front, the 2.4 gives several hints of Jaguar styling, but in a diminutive aspect. Flame throwers on bumper are optional equipment.

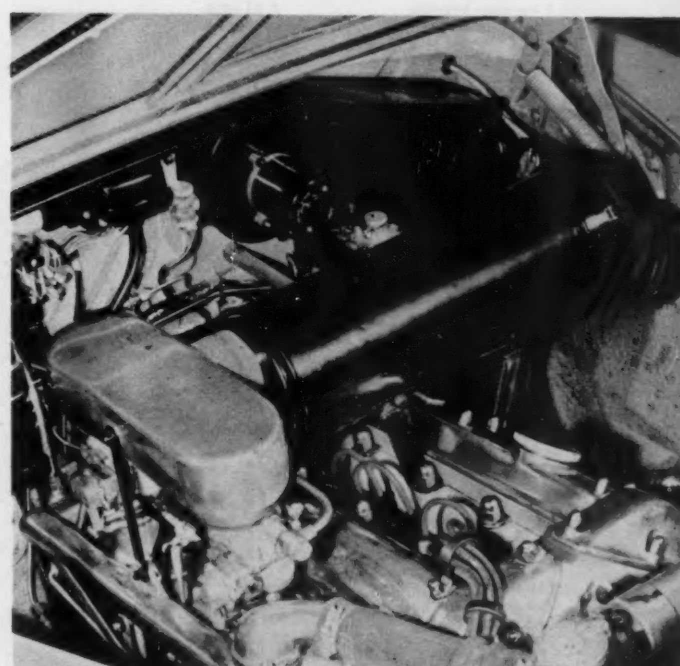
*Interior is rich in comfort and appointments. Tach sits at left almost before driver with other instruments well placed. Shift lever is far forward.*

with a vigor that's exaggerated by the somewhat slow steering ratio. You need a lot of helm to hold it into a bend, but only moderate effort. The car as a whole sticks nicely in fast highway maneuvers, and it can be very satisfying on fast corners. If it's thrown around more vigorously, however, the steering wheel response becomes delayed and erratic, due in part to the roll angle assumed. Unfortunately, there is always some tire noise, even at the front/rear pressures of 30/28 psi recommended in the manual for fast driving.

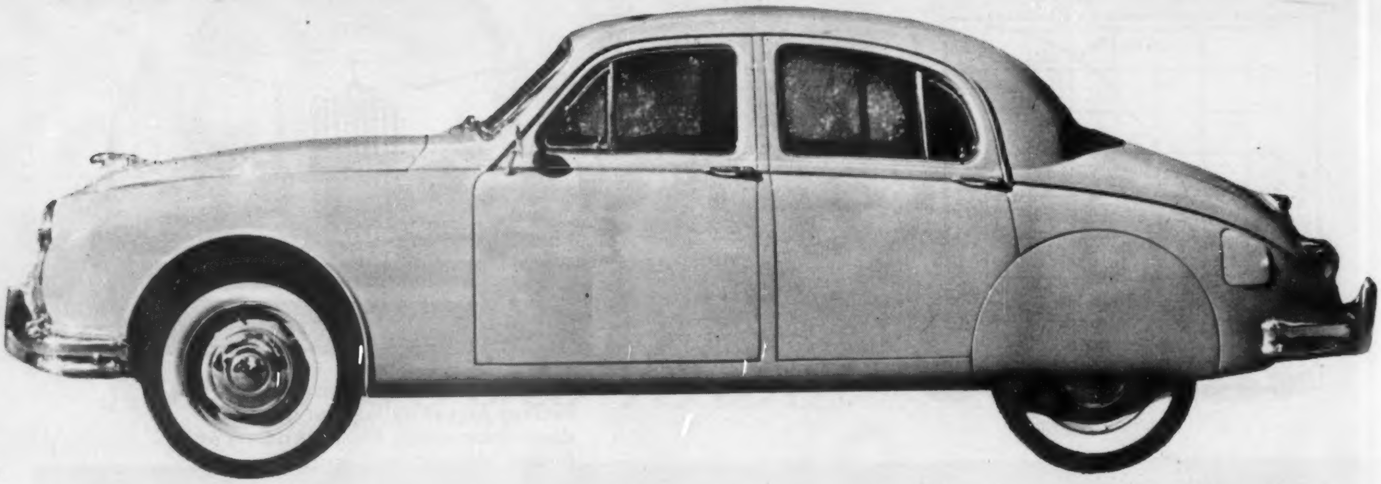
Taken to extremes, though, the car tends to drift on all fours, and rear wheel slides can be provoked but don't pop up without warning. Cornering on bumpy surfaces is good except at very high lateral G's, when some hopping occurs at both ends of the car. Briefly, the solidity of the car itself isn't always matched by the connection between car and road.

Thanks to this Jag's inherent stability, tracking on straight roads is easy and true, and is aided by a steering gear that is pleasantly sensitive for this class of car. Feel is direct at most speeds without excessive road reaction at the wheel. Characteristic of Jaguar is a strong caster action, and the steering is not light at low and parking speeds, though complete manageability is retained.

Competition know-how makes a welcome appearance



*Typically Jaguar, the 150 cubic incher follows design of previous engines with double overhead cams.*



*In profile, this first major new model from Coventry since the Mark VII combines the distinctive form of its predecessors, and the utility of sleek, advanced lines.*

inside the 2.4, which has its adjustable steering wheel placed at the authentic Grand Prix angle and distance, and along with the big, four-spoke design this may have induced us to push a little harder than usual. Heel-and-toe downshifting is also made easy by the pedal placement, the suspended pedals generally being fine and allowing acres of left foot room. The gearbox housing pushes up a big lump in the 2.4 floorboards, but not quite big enough to make a comfortable rest for the accelerator foot. One of the neatest things we've seen in a long time is the placement of the handbrake between the seat and the door at the driver's left hand. It's completely out of the way, yet right at hand and powerful when needed.

The service brakes are Lockheed's new Brakemaster system, which features power boost, automatic adjustment, and freedom from fade. On first acquaintance they didn't impress us, having an initially soft feel which stiffened up after application, as well as a tendency to be touchy at very low speeds. In our ten-stop-test, though, they were always on the job with a reasonably straight stop, and

## PERFORMANCE

**TOP SPEED:**

| | |
|---|---|
| Two-way average | 99 mph |
| Fastest one-way run | 99 mph |

**ACCELERATION:**

| From zero to | Seconds |
|---|---|
| 30 mph | 4.6 |
| 40 mph | 6.5 |
| 50 mph | 10.2 |
| 60 mph | 13.4 |
| 70 mph | 17.2 |
| 80 mph | 27.9 |
| | |
| Standing ¼ mile | 19.2 |
| Speed at end of quarter | 73 mph |

**SPEED RANGES IN GEARS:**

| | |
|---|---|
| I | 0–28 |
| II | 1–48 |
| III | 3–68 |
| IV | 10–99 |

**SPEEDOMETER CORRECTION:**

| Indicated | Actual |
|---|---|
| 30 | 31 |
| 40 | 40 |
| 50 | 50 |
| 60 | 59 |
| 70 | 68 |
| 80 | 78 |

**FUEL CONSUMPTION:**

| | |
|---|---|
| Hard driving | 16.5 mpg. |
| Average driving (under 60 mph) | 22 mpg. |

**BRAKING EFFICIENCY:**

(10 successive emergency stops from 60 mph, just short of locking wheels):

| | |
|---|---|
| 1st stop | 62 |
| 2nd stop | 60 |
| 3rd stop | 61 |
| 4th stop | 61 |
| 5th stop | 57 |
| 6th stop | 58 |
| 7th stop | 55 |
| 8th stop | 57 |
| 9th stop | 58 |
| 10th stop | 62 |

## SPECIFICATIONS

**POWER UNIT:**

| | |
|---|---|
| Type | six cylinder, in-line |
| Valve Arrangement | V-inclined, twin overhead cams |
| Bore & Stroke (Engl. & Met.) | 3.27 x 3.01 ins. (83 x 76.5 mm.) |
| Stroke/Bore Ratio | 0.923 to 1 |
| Displacement (Engl. & Met.) | 151 cu. ins. (2483 cc.) |
| Compression Ratio | 8 to 1 |
| Carburetion by | Z Solex downdraft, type B32.PB1-5/5 |
| Max. bhp @ rpm | 112 bhp @ 5720 rpm. |
| Max. Torque @ rpm | 140 lb-ft. @ 2000 rpm. |
| Idle speed | 600 rpm. |

**DRIVE TRAIN:**

| Transmission ratios | Rev. |
|---|---|
| Rev. | 3.375 |
| I | 3.375 |
| II | 1.962 |
| III | 1.367 |
| IV | 1.0 |
| | |
| Final drive ratio (test car) | 4.55 |
| Other available final drive ratio | Optional overdrive gives 3.55 |
| Axle torque taken by | Radius rods and leaf springs |

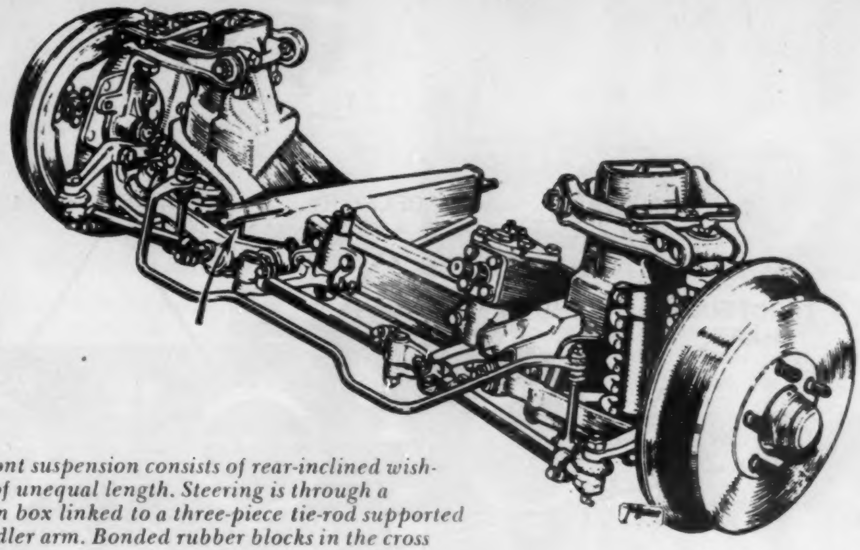
**CHASSIS:**

| | |
|---|---|
| Wheelbase | 107⅜ ins. |
| Front Tread | 54⅝ ins. |
| Rear Tread | 50⅛ ins. |
| Suspension, front | Independent, coil spring and wishbones |
| Suspension, rear | Cantilever leaf springs and radius rods |
| Shock absorbers | Girling telescopic |
| Steering type | Burman recirculating ball |
| Steering wheel turns L to L | 4¼ |
| Turning diameter | 33.5 ft. |
| Brake type | Lockheed Brakemaster hydraulic, vacuum servo |
| Brake lining area | 157 sq. ins. |
| Tire size | 6.40 x 15 |

**GENERAL:**

| | |
|---|---|
| Length | 180¾ ins. |
| Width | 66¾ ins. |
| Height | 57½ ins. |
| Weight, test car | 2960 lbs. |
| Weight distribution, F/R | 57/43 |
| Weight distribution, F/F, with driver | 57/43 |
| Fuel capacity — U S. gallons | 14.5 |

| **RATING FACTORS:** | |
|---|---|
| Bhp per cu in. | 0.743 |
| Bhp per sq. in. piston area | 2.21 |
| Torque (lb-ft) per cu. in. | 0.924 |
| Pounds per bhp—test car | 26.4 |
| Piston speed @ 60 mph | 1740 ft./min. |
| Piston speed @ max bhp | 2880 ft./min. |
| Brake lining area per ton (test car) | 106. sq. ins. |



*The front suspension consists of rear-inclined wishbones of unequal length. Steering is through a Burman box linked to a three-piece tie-rod supported by an idler arm. Bonded rubber blocks in the cross member transmit vertical and transverse loads from body to springs and shocks.*

held their moderate power well.

As usual with Jaguar, the instrumentation is comprehensive on the special equipment model we drove. There's a simpler, no-tach version available in England, but the 2.4 would be lonely without that instrument, which is placed on the driver's side. Although the dials themselves are well graduated and readable, visibility continues to be sacrificed to symmetry, and items like the water temperature are remote. Gauges are well lit at night, but there's no front map light, and the two interior lights are in the rear quarters but controlled from the dashboard.

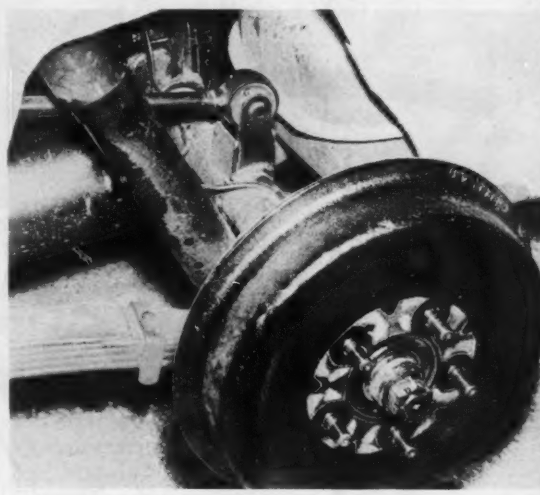
The small dash switches are now pushbutton-type, which are not entirely reliable, and the carburetor starting control works well, but is needlessly distant. The starter button is conveniently close to the ignition switch, from which the keys inevitably hang into the open ashtray. Interior storage space is exceptionally generous, with pockets in all doors and a roomy lockable glove compartment. Change for tolls can be kept handy in the open shelf on the driver's side.

From the driver's standpoint, then, the 2.4 controls are sporting but the car's reactions to them are more sedate and sedanlike. It narrowly misses being the perfect machine for the enthusiastic driver who needs family room, but taken strictly as a roomy five-seater, it's exceptionally safe and stable. The rear seat, of course, is fully usable with plenty of footroom, and thanks to both the level ride and adequate headroom, there's no tendency to rap skull against headliner as in many smaller imports. A hinge-down center armrest and two ashtrays complete the amenities.

All doors open from the rear by pushbutton, and have strong hold-open stays. When you walk up to the 2.4 you're pleasantly surprised by its compact lowness, which imposes some sport-car-like motions on getting in. The seats are raked well back, which contributes to the G.P. stance, and they have a just-right feel of firm cushioning. They don't form-fit too closely or support the shoulders well, though, and some extra fatigue on long hauls results. The front-seat passenger in particular finds himself clutching for support. Adjustment is made easy by a long spring-loaded track that fairly flings you into the dash when released.

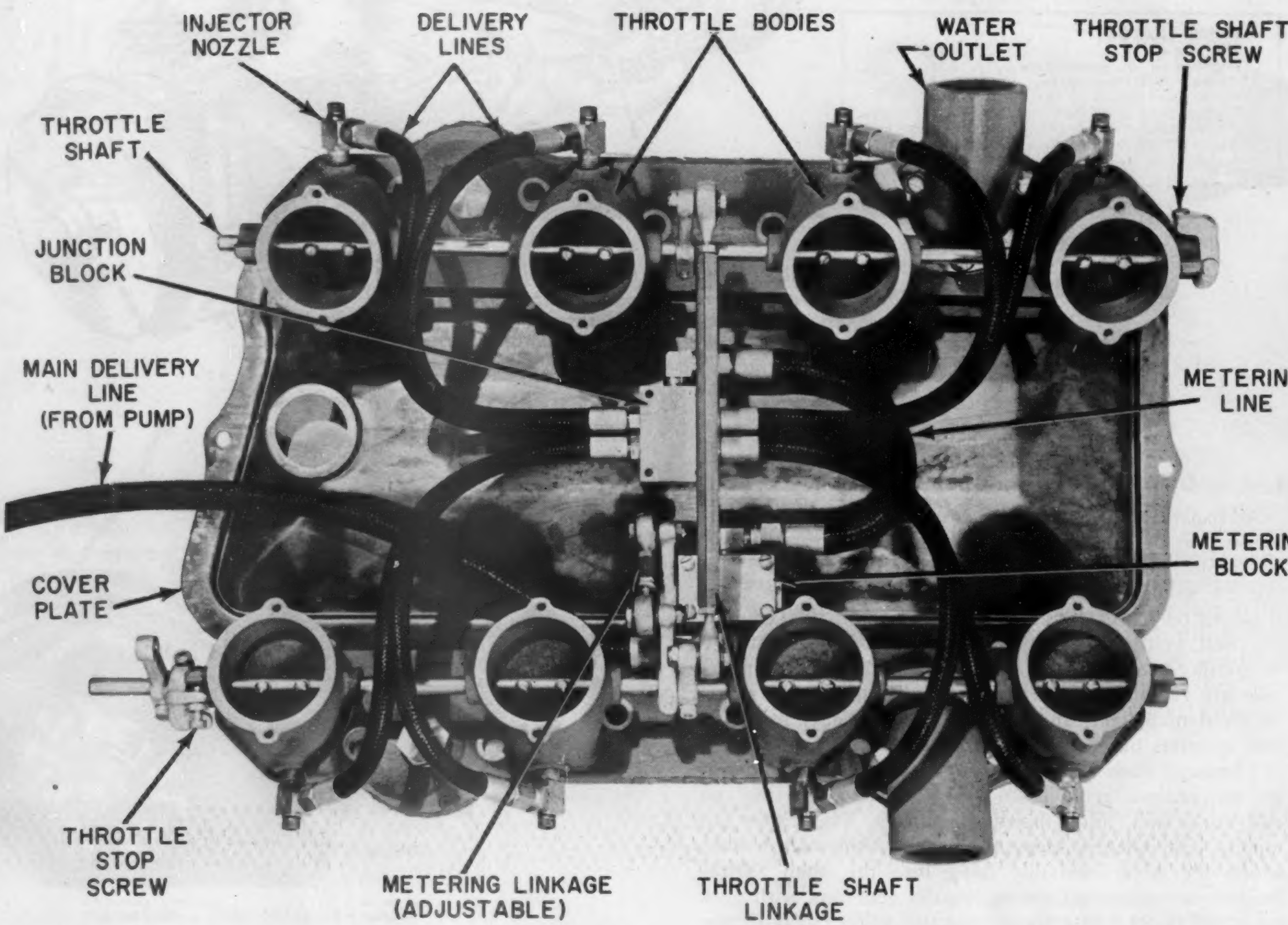
Though the hood is impressively long to the onlooker, it falls away rapidly and allows very good forward vision with both fender peaks defining the limits of the car. The

*(Continued on page 55)*



*Rear axle setup shows cantilever spring, angled shock absorber, upper locator arm, and part of the gas tank.*

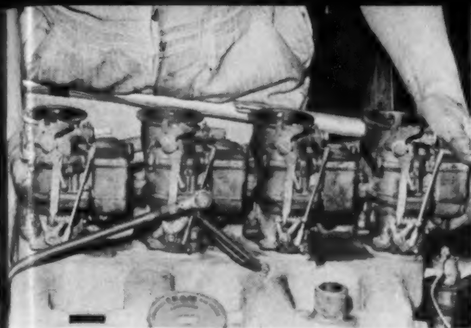
*At 55 mph around bend, two point four seems to be sliding toward outside. Actually car stayed glued to road.*




*Two cars are proving gasoline injection in competition. Here is how one of them was set up in just 3 hours.*

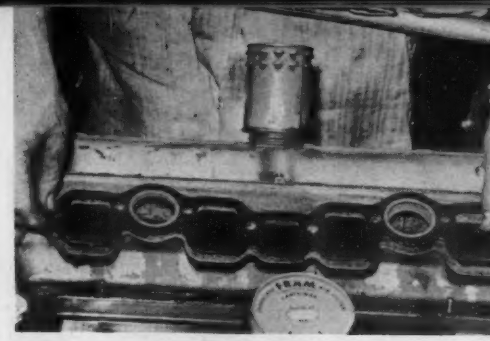
By ROBERT LEE BEHME

# 40 EASY

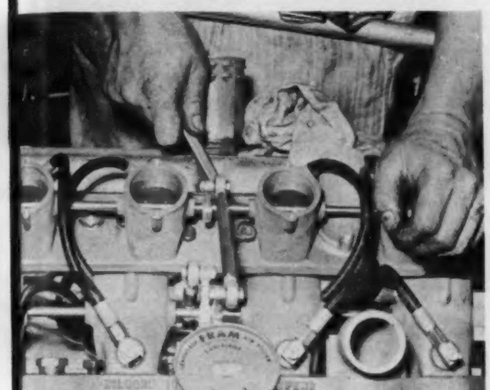


*1 Chrysler set up for racing delivered 385 hp, but lacked instant acceleration. Carburetors, fuel lines and wires are dismantled.*

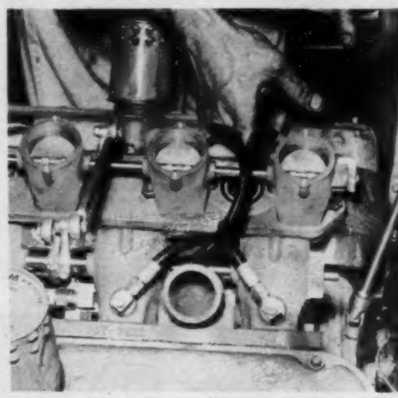
*2 Stock valley cover can be sent to kit maker, or a new plate with junction block can be had. Junction block must be installed at factory.*



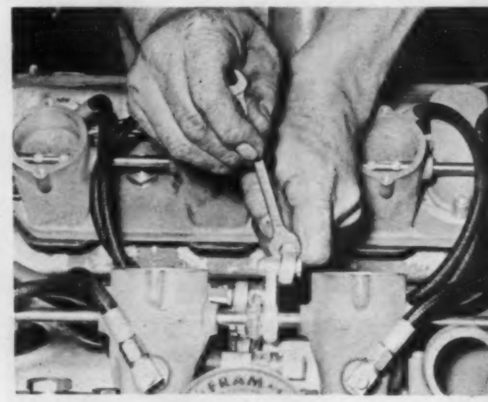
*3 A new thin gasket is installed to replace gaskets which were removed. Thicker stock gaskets may cause throttles to stick when opened.*



*4 After valley cover and injector bodies are positioned, bolts are tightened, and torqued to proper specifications at room temperature.*



*5 Idle mixture and speeds are set at factory, require little adjustment. Idle is adjustable by turning locknut on throttle screw.*



*6 Linkage between valve & throttle shaft is turnbuckle. To lean mixture, lengthen link; to enrich fuel, shorten. One turn is enough.*

THE dreamy eyes of the out-to-win sports car owner are to the future. He sees, in days ahead, more power, greater fuel economy and a prompt, snappier acceleration when he wants it. He sees all this in the fuel injection systems which Detroit engineers have yet to deliver.

The sports car owner, especially ones running American equipment, sit out the waiting period with unconcealed impatience. But there are some who refuse to wait: "Injection is here," they say, "why wait?"

Why indeed? One company alone, the Hilborn-owned Fuel Injection Engineering Company of Santa Monica, has more than 400 injection equipped cars running today. The Hilborn system has been installed on such varied engines as Chrysler, Dodge, De Soto, flathead Fords, OHV Fords, Mercury and Lincolns, Cadillacs, Oldsmobile, Buick, OHV and plain Chevrolets, Studebaker V-8 and Wayne or Horning equipped GMC engines. The average cost is $275, complete, ready for installation. They aren't alone, either. There are at least two other companies now in limited production.

The fuel injection system is still a rarity at racing events, but numbers are increasing as drivers begin to take advantage of the increased power and smoother fuel flow of the systems; the latest Jack-the-Bear equipment has injection.

One such owner-driver is John Barneson, who, with engineer George Naruo and designer Jack Hagemann, decided to throw out the four Stromberg 97's which decorated the top of their 385 hp Chrysler powered special in favor of the more efficient Hilborn system.

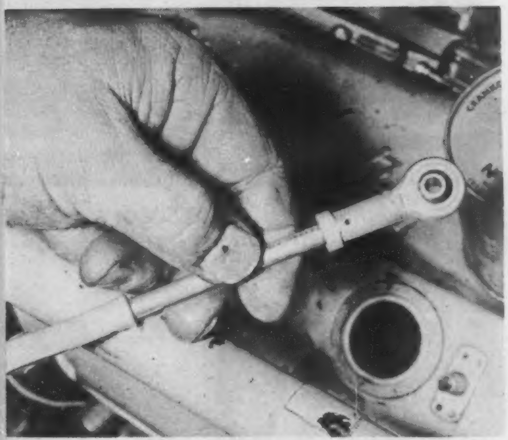
By strictest definition, the Hilborn system, and systems with similar design, are not "pure" injection methods, but simplified injector-carburetors bolted directly to the intake ports. Fuel is sprayed into the air stream of each injector riser under a comparatively low pressure (less than 23 pounds). The mixture of fuel and air still depend upon the action of the intake valve.

According to injection engineers the "pure" system is more direct: nozzles are located in the combustion chamber. Fuel is sprayed under pressure directly to the chamber. "But whether the Hilborn system is pure or not," Naruo says, "the increase in power and operation which it triggers is unmistakeable."

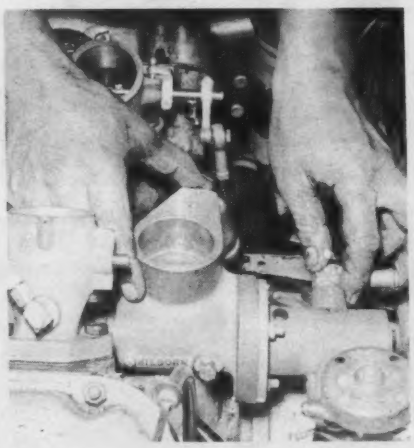
The equipment was ordered from Hilborn, completely assembled, flow-tested and ready to install. Idle mixture and idle speed are set at the factory and require no adjusting. It takes but a few hours to install; George consumed less than three. The photos show how the job was done.

*Continued on following page →*

# HORSES



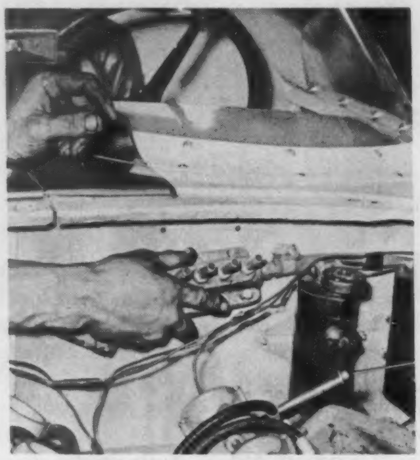
**7** *Foot pedal must next be linked to throttle. All that is necessary is a switch-over link which changes forward motion to side movement.*



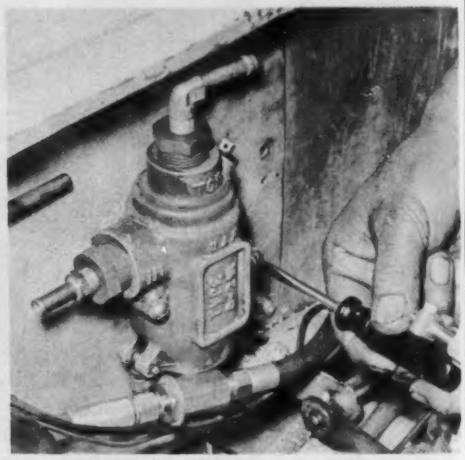
**8** *Combination of fuel pump and distributor drive unit is installed in normal distributor slot. First shorten the distributor drive shaft.*

**9** *Reason for cutting drive shaft. Unit would be above seat of the pump. The Spalding distributor would go above the hood cover.*

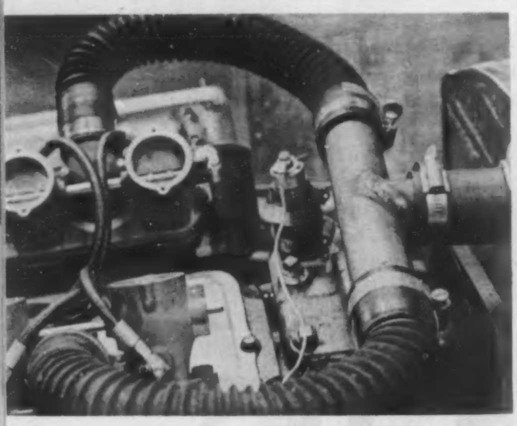
**12** *Pump from kit is connected. Metering jet hose connects to pump outlet. By-pass container joins the line to the fuel tank.*



**13** *High quality filter is necessary with injector systems. Stock fuel block or fuel filter bolted to fire wall is removed and discarded.*

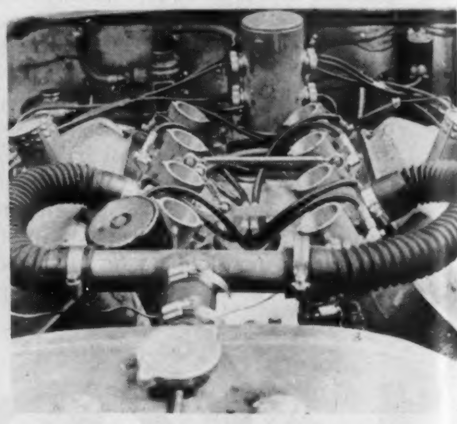


**14** *Hilborn suggests aircraft filter, C1A (small) or C2A (large) or both. Ceramic or laminated filters are not recommended.*



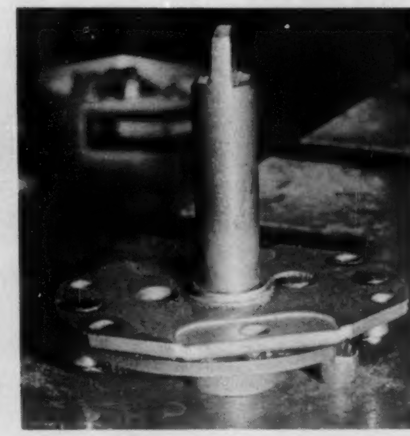
**17** *New water connection is necessary on injector system. Home-made "T" connects radiator to injectors through flexible hose.*

**18** *Distributor is hooked up and statically timed. Fine tuning is done on chassis dynamometer and is a must with injector systems.*

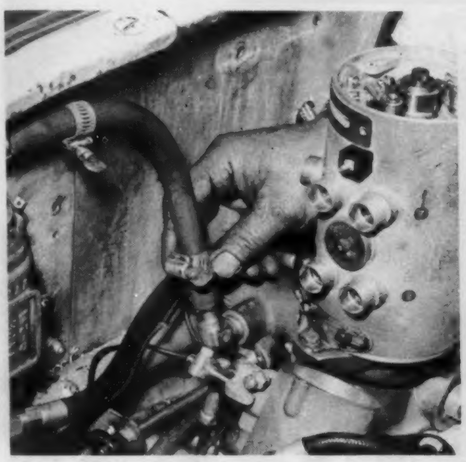


**19** *This is the completed fuel injection set up ready for firing. The new installation yielded nearly 400 hp, and instant pedal response.*

**10** *The aligning pin on the drive of the distributor must first be removed so that shaft can be dismantled before cutting to right size.*

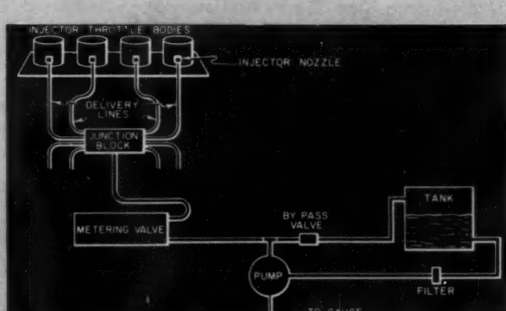


**11** *This is how the shaft looks after it has been cut and reground with the standard slot-end. This is a must on all distributors.*



**15** *Hoses can now be installed. Half inch line is used to fuel pump. Return line is 5/8 inch, Neoprene hose with clamps is best.*

**16** *Return 5/16 line to the tank is being connected. Line must enter tank above the fuel level, and fuel cap should be air-vented.*




*Schematic shows set up to one bank of injector throttles. All delivery lines should be exactly the same length to insure equal flow and pressure to all nozzles.*

## Tuning Tips

**Here's what Stu Hilborn, president of Fuel Injection Engineering says for first-time users:**

1. *Start with R-11 plugs or the equivalent. Generally the plugs take a long time to show any color. This is due to the extreme clean-burning of the finely atomized fuel. Do not change the mixture because of plug readings based on only a few laps. Pay more attention to the indications on the tops of the pistons than to the plugs.*
2. *Fuel consumption will be far less than with carburetors; perhaps only 50 percent or 60 percent. On long races the fuel load may be materially reduced.*
3. *Gear ratios may be raised slightly as a result of the increased horsepower.*
4. *Extreme smoothness of power makes control easier for the novice drivers, but may cause them to under-estimate the acceleration at times.*
5. *In case of any trouble, disconnect the nozzle hoses, remove nozzle caps, and blow back through the nozzles with air pressure. If it still fails to operate correctly, send the injector and the pump to the factory for test. Do not permit well-meaning but uninformed persons to tamper with it.*
6. *Do not allow the fuel level in the tank to get down to the last gallon as it will wash away from the pickup in the tank when the car is in the turns. The resulting gulp of air sucked in will give a momentary misfire in the engine. This is the first warning when running low on fuel.*
7. *Avoid the tendency to fool with the adjustments continuously. The unit is ready to run as received. Install the injector, select the desired by-pass jet and go out and race.*
8. *The seals in the fuel pump should be replaced every year.*
9. *Shut the fuel off when the engine isn't running to keep the nozzles from dripping.*
10. *After the car has been standing with the engine hot, it may be noticed that the throttle sometimes becomes a little tight. This is due to the aluminum casting picking up heat from the engine and expanding. As soon as the engine is started the fuel spray cools it down and the throttle frees up immediately.* #

*At Pebble Beach, Wright twists his Renault Special around last hairpin turn before straightaway to starting line. Here, car ran well up in class.*

***The result of four months of after-hours work, this tiny Renault special is one man's answer for power at a price.***

*By LEE EDWARDS*

# BUDGET BOOMER

ACCORDING to Vale Wright, racing is a peculiar sport with a firm rule about substitutions: no substitute for inches can win a race and no substitute for money can build a car. Wright, who has been an ardent fan of West Coast racing around his Berkely, California, home, dropped out of active participation when he found that costs of his special plastic-bodied M.G. were skyrocketing like the national debt.

This season Wright was inflicted with a particularly severe case of the urge-to-compete. He succumbed, but as he recently said, "I was determined to be as tight-fisted as a trapeze artist about this one. I wanted a real boomer, but I set my total costs at less than $1000."

He knew that that kind of money ruled out the big cars. If he wanted a winning combination, he felt the only answer was a potent small car.

Wright made his decision: Class H competition. His decision was clinched when a wrecked Renault was offered to him for $125. He bought the car and was in business. The result, four months later, is a potent budget boomer for $800.

He discarded the body and frame sections, saving the axles, suspension, spindles, clutch and brakes. He planned to build a lightweight racing frame to house these stock parts.

Using 2¼ inch tubing, he built the basic longitudinal frame members with a roomy kick-up in the rear. Two cross-members were used, aft of the center, to tie the frame rails together. He installed the stock Renault wheel assemblies, with their independent coil suspension, on a 78 inch wheel base. He kept the stock tread of 47 inches.

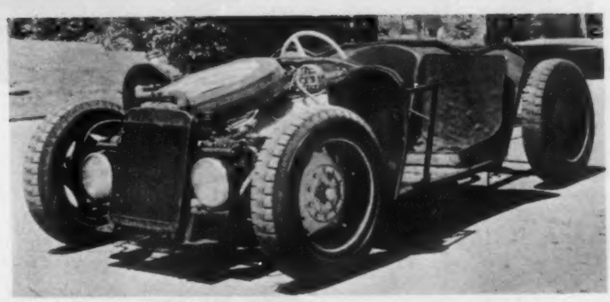
To improve the weight distribution of his tiny machine, Wright reversed the Renault engine, placing it ahead of the

*The engine hatch was cut into the body after the mold was completed. Louvered cover is aluminum. Rear lanterns are '53 Ford tail lights.*

rear axle in place of the after-axle location on stock models. A direct drive hooks to the rear wheels. Tire size, front and rear, is 5.20 x 15. Up front, between sheet aluminum and thin vertical bracing above the frame, he left room for the required spare. It helps coordinate balance, which Wright set at 50/50. Alongside of the spare, Wright installed the stock Renault steering which he modified to center steering through the use of A.C. universals.

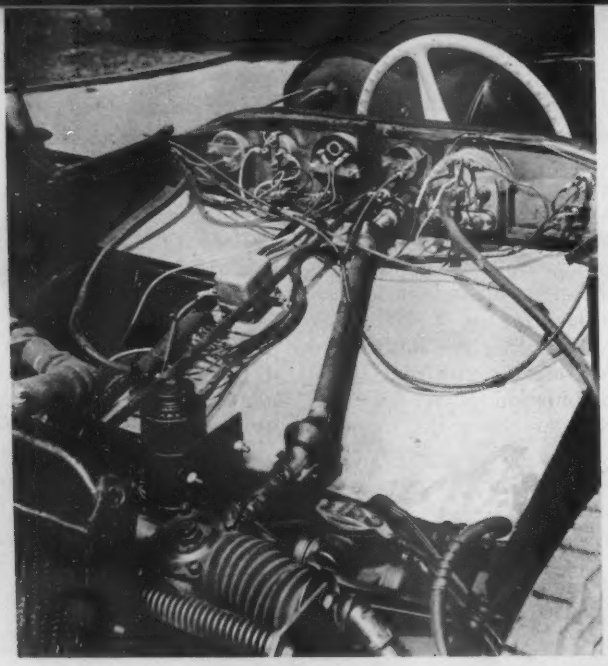
To further the much needed balance, Wright installed the radiator up front, ahead of tire and headlights. A combination of rubber hoses and copper tubing carries water aft along the frame rails to the engine. On either

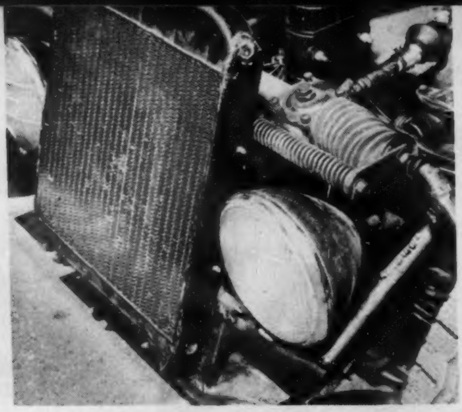
*The shell of the Renault Special was built from two early MG Special mold nose sections and joined aft of the cockpit. Grille is from Thunderbird.*



*All that remains of Renault on this 78 inch wheelbase are the axles, suspension, spindles, clutch, brakes and engine. Note location of spare under hood.*

*This rear view shows the high kick-up in the rear needed for new engine hanger built by Chuck Clemens. Engine is reversed, set ahead of axle to improve weight distribution.*

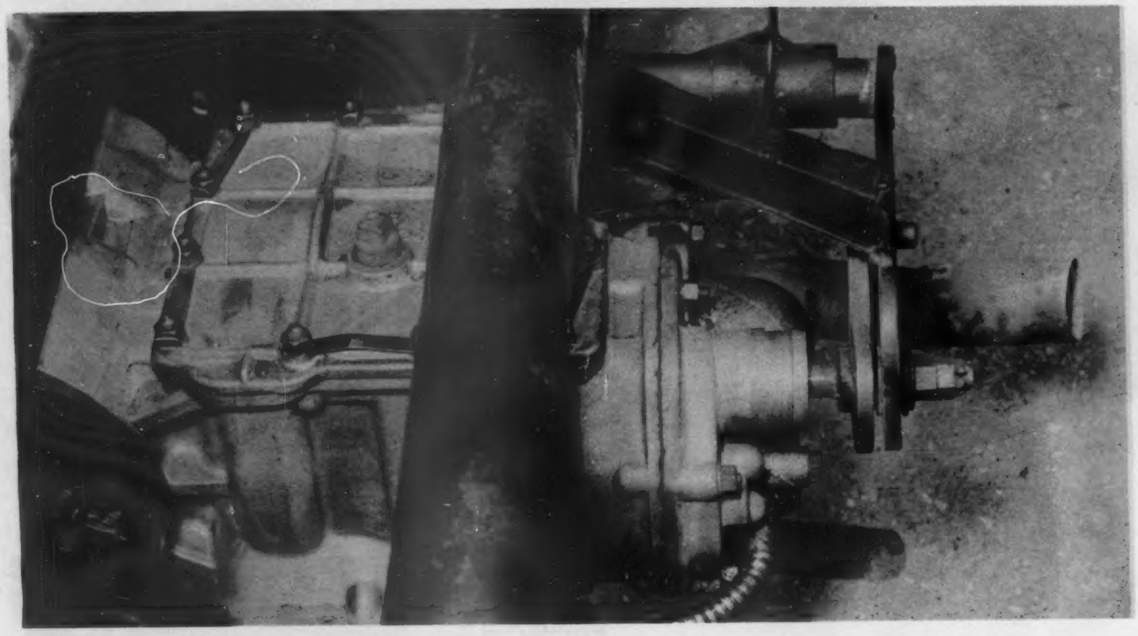




*Put forward for better cooling and weight distribution, the radiator is connected to the engine thru hoses and copper tubing.*

*LEFT: A.C. universals used to adapt stock Renault steering assembly to center steering for easier handling.*

*BELOW: Scotch yoke transmission linkage is anchored to rear of transmission. Flat stock coming from yoke activates bell crank which is welded to shift rod.*



*Rear view of scotch yoke. Bar part of yoke connects to stick shift at front. Slotted plate moves up and down, in and out, operating bell crank.*

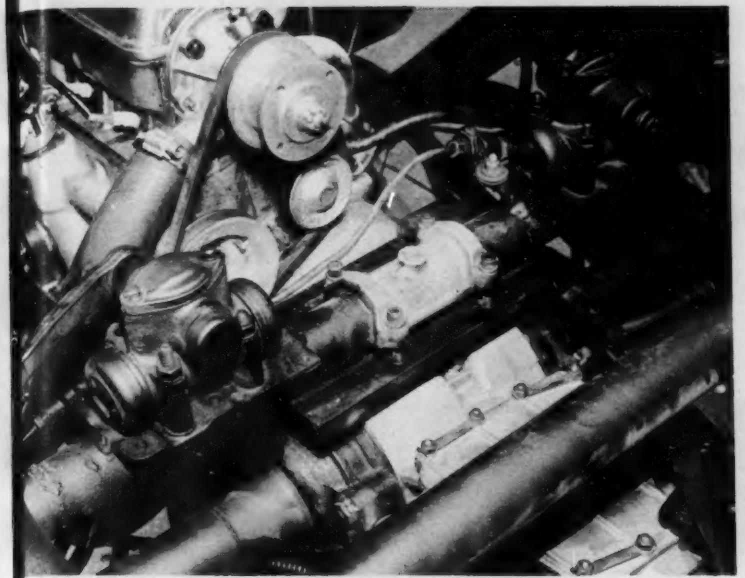
side of the radiator, he installed Crosley headlights.

In the rear, the reversed Renault engine was fitted, then removed for limited souping. Bore and stroke were kept stock: 2.146 x 3.15. Intake valves are 27mm and exhaust valves are 25mm. Stock valve springs were used.

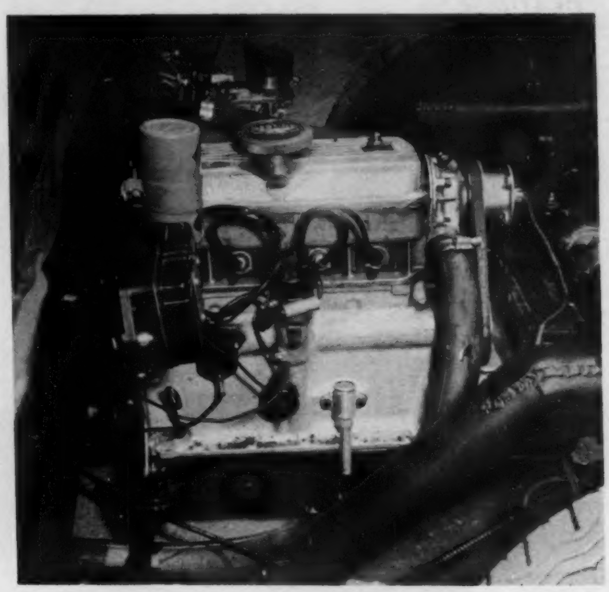
Wright purchased a special Renault-built racing cam. The new cam, a hot one, has a split overlap and when Wright tuned the engine, he used 00 dial indicator setting for valve opening and .063 before zero on closing.

The stock rocker set-up was retained, and Bosch plugs are used with the 7.5 to one compression.

Perhaps the most interesting innovation on the car is the solution to the problem of transmission. Wright found it necessary to reverse the transmission, turning it 180 degrees, which put the fork aft of the housing.

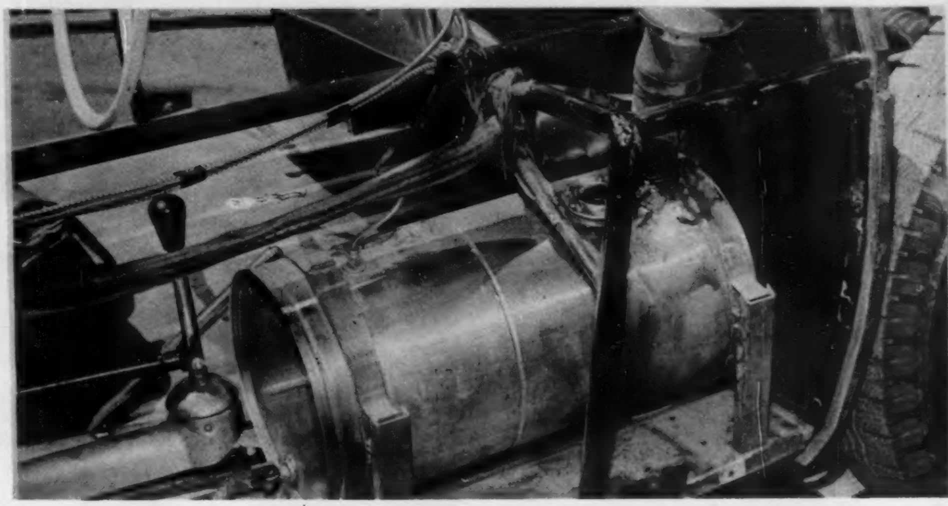


*Because of the switch in engine and transmission layout, a special hanger (U clamp) was suspended from cross member and bolted to transmission case.*



*The reverse mounted engine was kept stock except for a special Renault-built racing cam. The split over-lap requires precision timing when tuning engine.*

*Gas tank holds four gallons, and is mounted beside driver. A visual gauge is used at top of tank just behind the filler neck.*



Chuck Clemens, of Oakland, devised a "scotch yoke" as the most economical answer. The yoke is a slotted plate which fits over the transmission fork arm. A semi-solid linkage leads to the shift lever in the cockpit. As the stick is moved, the arm pulls the yoke in, out, up and down, to select the proper gear.

Throughout the project, Wright was interested only in building the lightest, cheapest yet best car possible. He was hoping to rely more on weight than on a hot engine. To complete his treatment, he built a body of plastic.

There were two reasons for his choice: (1) the weight saving qualities of plastic were substantial, and, (2) his special bodied MG had been a plastic job. Wright still had the original plaster of Paris mold for the MG body.

As it happened, the nose section of the MG body was a perfect fit for half the Renault special. "When I saw the fit of the nose section," Wright said, "I could hear opportunity knocking."

The body of the Renault is built from two MG special nose sections, joined aft of the cockpit. A Ford Thunderbird grille was cut down and mounted in the nose and 1953 Ford tail lights have been mounted on the rear. Painted a Silver Eldorado lacquer, the car looks low and potent. With a top speed of somewhere around 83 mph, Wright relies on cornering to place well up in the events.

Loaded, the special weighs 862 pounds. Considering the total outlay of $800, that's just about a buck a pound. Is Wright pleased? "A buck a pound seems a good price," he said, "you can't get steak for that money today." #

***"At around 2600 dollars complete, it will be surprising if a good many more of these potent little cars do not find their way across the Atlantic."***

*By ALBERT DOUGLAS*


*The 1956 experimental Elva with De Dion rear suspension. Ford engine has Elva IOE cylinder head, four Amal carbs.*

# Special from Sussex

A comparatively new name in racing circles, the Ford-based sports/racing Elva is nevertheless amassing a formidable list of competition successes. In 1955, the first year of "production," first places were gained at Brands Hatch, Aintree and Charterhall, as well as many 2nds and 3rds and a class win at the Prescott Hill climb. At the Bodiam Hill climb in October, fastest time of the day, irrespective of engine capacity, was scored.

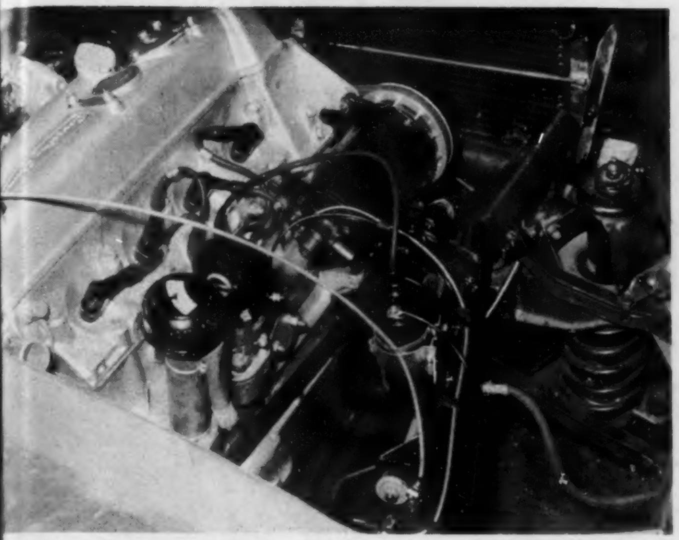
Obviously, a new name does not spring into prominence without a background of experience, and Elva Chief Frank Nichols measures up to this requirement in every way. Just over two years ago he was enjoying an amazingly successful season as a driver with a Ford-engined C.S.M.—a light, tubular-framed special with swinging-axle front suspension.

Nichols, a native of "Silly Sussex" gave up racing at the end of 1954, and with his chief mechanic "Mac" Witts devoted himself to the evolution and design of the Elva sports car. Mediaeval county titles were once again proved to be misnomers, for the design and performance of the Elva, or to be more accurate, Elvas were anything but silly.

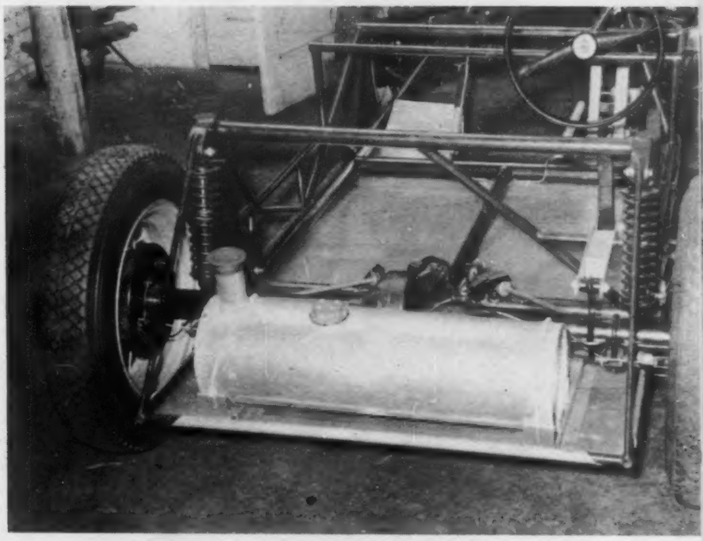
Nichols' creed was simple enough. He wanted to produce a machine which was capable of acquitting itself honorably against serious opposition in the small-capacity sports classes, and to embody where possible, existing standard components which were not only readily obtainable, but simple in design and easy to service. He has certainly adhered to these ideals and the cars fully justify the derivation of their name—Elle Va, French for "She Goes."

Basis of the Elva is a lightweight "space-frame" constructed of 18 and 20 gauge steel tubing varying in diameter from a ½ inch to two inches. There are three main tubes of two-inch diameter and the whole structure tapers towards the front end, where a rigid bridge-like structure supports the front suspension. The frame weighs but 75 pounds complete with duralumin belly-pan, the latter item also assisting in stiffening the structure.

Front suspension is independent by coil springs and wishbones of unequal length, and is in fact the complete, as fitted to the British economy (but surprisingly fast), Standard "Eight" saloon. The assembly, attached to its mass production steel pressing, bolts straight to the Elva frame through rubber bushes, and has proved entirely satisfactory under racing conditions. This form of construction materially assists in keeping production costs at a low level, and ensures an easy supply of reasonably-priced spare parts. Shock absorbers are normal Standard "Eight", but the coil springs are special. Cast iron brake drums of seven-inch diameter are the usual equipment, but bi-metal drums can be specified at



*Coventry Climax engine fits neatly into the Elva frame. Front running gear detail shows unequal length wishbones with shock inside spring.*



*A Ford Prefect rear axle is converted to take coil springs with telescopic shocks. Note duralumin tray under space frame.*

extra cost. The iron brakes are very efficient, the front with two-leading shoe operation, and with only around 900 pounds to arrest.

Steering box and much of the steering gear is also Standard "Eight," but there is a special lightweight column to the two-spoke Standard steering wheel. Light-alloy wheels of handsome appearance with leather binding and padded rim are available at extra cost. Accent is on light weight right through the specification of the car. The cut-down Morris radiator weighs only 12½ pounds, the three inch rim front wheels are 12 pounds each, and the four inch rear wheels are 14 pounds each.

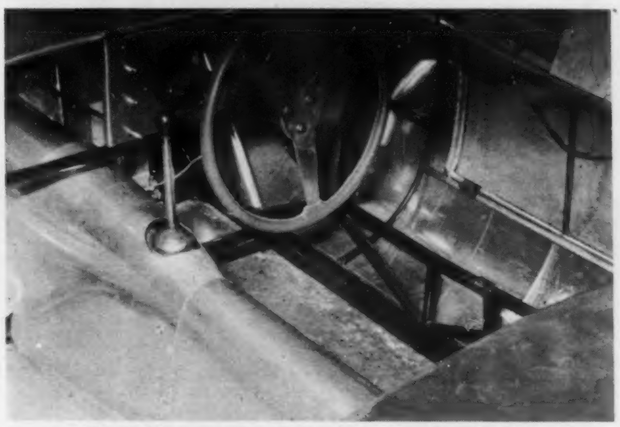
Rear suspension is non-independent by the latest type Ford Prefect, which is modified by the Elva Engineering Company to accept coil springs instead of the normal Ford semi-elliptic leaf springs which are, of course, heavier. The axle is located by tubular trailing arms and a transverse reaction rod, and tubular hydraulic dampers are fitted.

Most small engines can be accommodated in the frame, in fact one has been fitted with a 1500 cc Maserati "six" (ex-supercharged single-seater), but power units usually chosen are the ubiquitos Ford "Ten" or the potent 1100 cc Coventry-Climax with light-alloy block and single overhead camshaft. With the Climax installed, the power-to-weight ratio of the Elva approaches 200 bhp per ton.

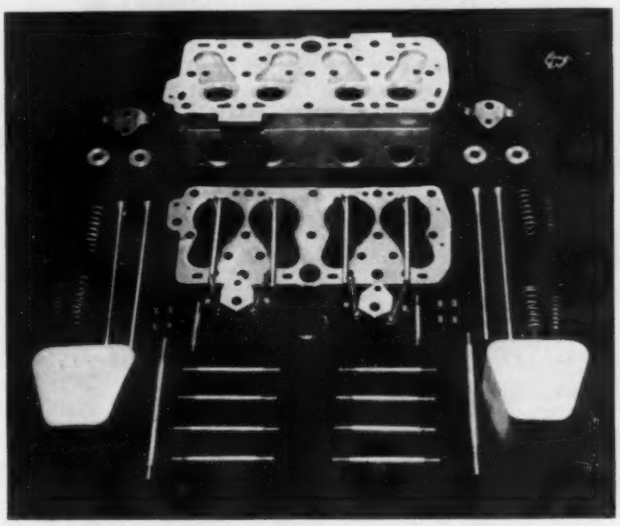
Several Elvas are fitted with the comparatively expensive Climax unit, but Nichols continues to enter his "factory" machine, driven by "Robbie" Mackenzie-Low, with a Ford-based engine. Nichols has had a great deal of experience with these inexpensive engines; his own very successful C.S.M. was powered by a flat-head which was both powerful and consistent.

Nichols has come a long way, however, since the days of his highly-tuned flat-top, and he produces in addition to his Elva cars a special Elva cylinder head with overhead inlet valves which converts the small Ford engine into a unit of real potency. Not only does it fit the sports racing engine, it will bolt on to any later-type Ford Anglia, Prefect, Squire or Escort car, or Thames light truck. Performance increase is

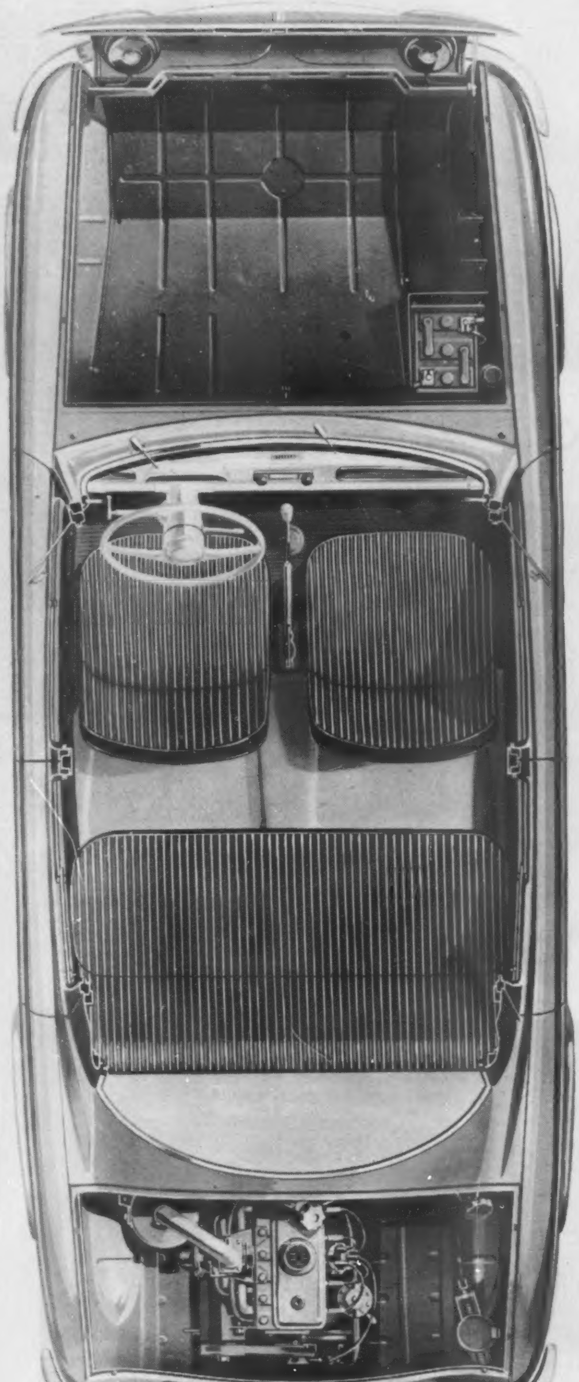
*(Continued on page 56)*



*Elva-Climax in construction. Gearbox is MG TC, usual equipment with Climax engine. Drop down door is aircraft type, wheel is light alloy.*



*Elva light alloy head has overhead intake valves and converts the 1172 cc side-valve Ford engine into a small-bore-head screamer.*



*Top view cutaway reveals seating arrangement, rear engine placement, and wide luggage space under front hood.*

# SCI ROAD TEST:

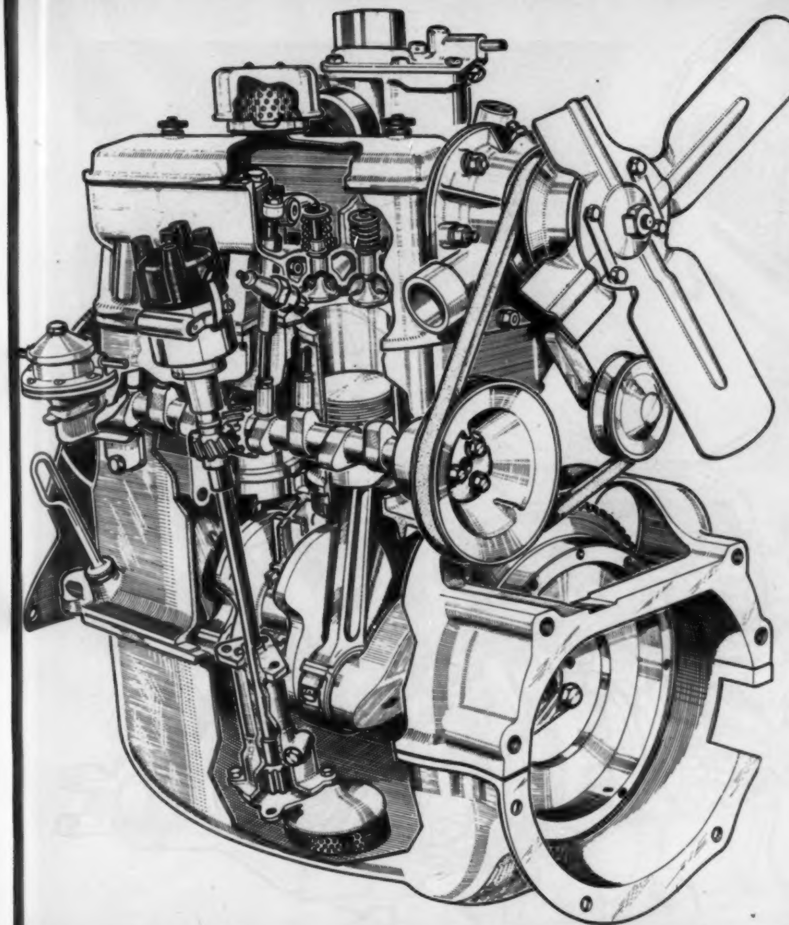
# The Renault Dauphine

THE first time you climb into a Renault Dauphine and slam the door you will hear not a solid classic thud but a metallic clang that will remind you of every underpowered economy car you've ever driven. But do not let this first impression congeal into an immediate judgment. The Dauphine's displacement is just 845 cc's (51.4 cu. ins.) and its power-to-weight ratio is none too impressive on paper, but the car goes — far better than many machines with 1200 cc's or more.

The Dauphine's first sally in competition, in the last Mille Miglia, surprised a lot of people. Before the race some critics, with other axes to grind, predicted sourly that the Dauphine's rear engine would give it "too much weight at the rear — dangerous oversteer." But the little Renault swept the 751 to 1000 cc class. Trintignant, Rosier and Paul Frere, crack grand prix drivers, brought their Dauphines in second, third and fourth, first place went to a Belgian girl named Gilberte Thiron who averaged 65.85 for a thousand miles over drenched roads and under streaming skies. Mlle. Thiron, who held the car at its 74-mph top speed most of the way, obviously did not share the critics' qualms about its handling characteristics.

Probably the only other people who weren't surprised by the Dauphine's stamina and stability were Renault's management, engineers and test crews. They put five years of development into the new car and shook it down to the last squeak and rattle over more than two million test miles. Besides, the Dauphine embodies the experience gained from the production of nearly 800,000 copies of the 4CV Renault.

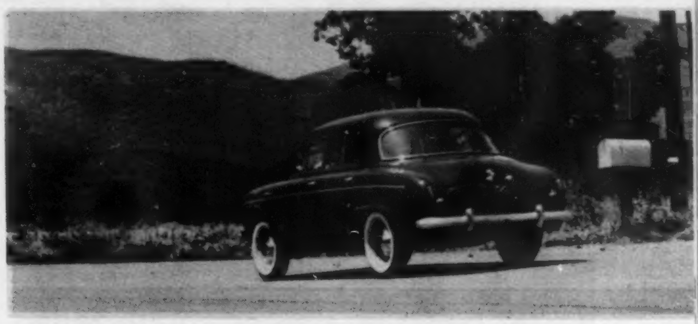
The Dauphine does not supercede the sassy little 4CV, but instead plugs the gap between the 4CV and the "big" two-liter Fregate. It is, in a real sense, a luxury version of the 4CV. To step from a 4CV to a Dauphine is to move from a car that is small and feels small to one that is not precisely big but feels as though it is. The Dauphine is




*Telltale louvers in the rear just above bumpers are the only indication that the Dauphine is a rear engined vehicle.*

*Engine's identical to 4CV save for larger bore. Crank is carried in 3 mains and camshaft sits high in block reducing pushrod lengths.*

*At an actual 45 mph, Dauphine enters test curve tenaciously gripping road surface.*



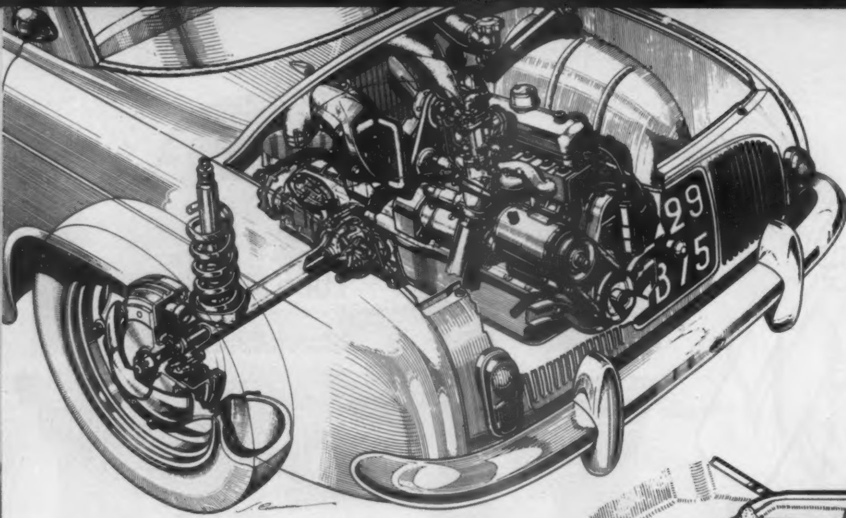
*Slipping through turn, body does not ride flat but maintains a normal relationship to suspension.*

roomier in every dimension, quieter, smoother, faster, holds the road better and is less subject to side winds. And these points of superiority hold when you compare it not only with the 4CV but with many of its direct competitors.

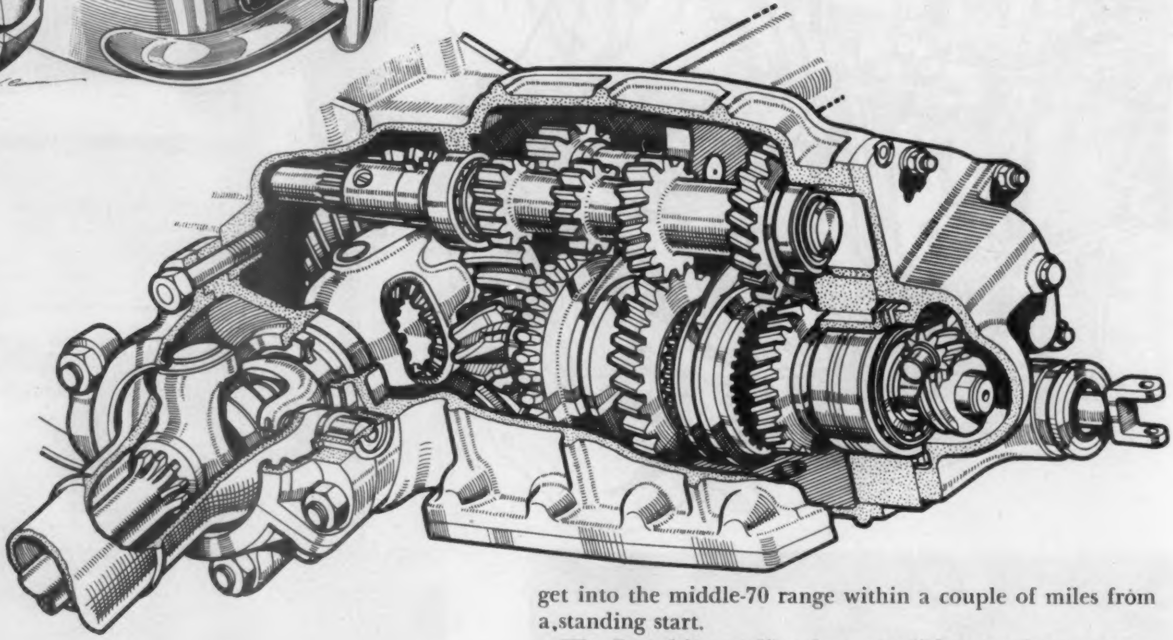
Probably the most important single criterion in the light-car class is size. There is little point in buying a four-five passenger car if it has no leg room for the rear-seat passengers, and certainly such cars have been built. But the Dauphine isn't one of them. Even with the front semi-bucket seats in full retreat – 5.25 inches adjustment is available – leg room in the rear is adequate for all but very tall riders. The front-wheel arches in this compact car do encroach upon front-passenger leg room, but in this case it's no hardship. The fact that there's no hump for transmission or driveshaft means that the entire floor area is uncluttered and useable.

Headroom, front and rear, is generous and the rear seat is wide enough for three adults to ride comfortably, if not cozily. The luggage space, under the hood at the front, has a very useful seven cu. ft. capacity. This is achieved in part by mounting the spare tire and rim in a separate drawer-like container under the front of the car – a logical solution to the problem of what to do with the space-robbing thing, and one that's likely to be widely copied.

About equal in importance to space in a light car is pace, and just where the Dauphine gets the degree of urge it has – enough for it to run away from cars with several hundred cc's more displacement – is pretty hard to figure. It gets no less mysterious when you raise the rear deck lid and take a good look at the tiny, far from radical engine. But the brawn you want is somehow always there, instantly responsive to the throttle. On long grades the car's eager top-gear pulling power is so disproportionate to the size of the power plant that it's laughable. Acceleration for passing in top gear is very good up to about 55 actual mph. Beyond this point the curve flattens out markedly, but you can still



*Engine, transmission, and final drive sit snugly in rear compartment. Independent axles swing at inboard ends, and accelerating and braking torque is controlled by needle bearing trunnions at these pivots.*



*Constant mesh transmission and final drive sit at head of engine as one unit. All three forward speeds are indirect, and top two gears can be shifted instantly without clashing.*


*With the Dauphine, Renault swept the 751 to 1000 cc class at the last Mille Miglia competition. A Belgian girl, Gilberte Thiron, averaged 65.85 for thousand miles in the wet.*

get into the middle-70 range within a couple of miles from a standing start.

The Dauphine, unlike the many light cars that are more reluctant than ready, tugs at the reins and asks to be driven hard. The engine winds and winds, and with great willingness goes way beyond its nominal 4250 rpm peaking speed. According to calculations that include the test car's loaded wheel radius, the engine was turning about 4750 rpm at our highest clocked speed of 74.5 mph, and it still felt limber, free and fully capable of 6000.

It's interesting, incidentally, to note the importance that a couple of thousand break-in miles can have on speed and acceleration. Our test car was one of the first two Dauphines to reach the West Coast, and the same machine was tested by another automotive magazine when the odometer registered about 2000 miles. When we ran it, it had gone another 2000 miles, and the difference in the results is fairly striking:

| | 2000 miles | 4000 miles |
|---|---|---|
| 0-30 mph, secs. | 8.1 | 6.7 |
| 0-60 mph, secs. | 37.7 | 30.5 |
| Top speed, mph | 72.0 | 74.5 |

At our top speed the speedometer was indicating 76 mph, which seems only slightly optimistic. But this was just because the needle was pegged at that point. Actually the speedometer is very liberal indeed, and before the needle stalled was running about eight mph off toward the far end of the scale.

The Dauphine's chassis is very well conceived and in spite of the rear engine location and the heavy loading of the rear wheels, oversteering tendencies are barely perceptible most of the time; perceptible but not remotely inconvenient when you hurl the car hard into corners. The car does not perform Porsche-pirouette power-slides with any great eagerness and feels far better when it goes through


*Hanging from the light alloy cylinder head the bunch of bananas exhaust converges directly into muffler beneath belly pan. Note accessibility of engine.*

the bends with all four treads biting the pavement. This it does up to very high speeds with complete composure and it feels no less secure tracking a right-angle bend at 40 mph than it does at 20. This observation was confirmed by my wife and kids who rode the rear seat during a brisk cruise on winding mountain roads. Constant fast cornering did not even jostle them.

Actually, although the Dauphine is definitely a fast-cornering car, it's one of those taut jobs that feels faster than it really is. This illusion is a result of the car's grip on the road, its high degree of roll stiffness, and its quick, accurate steering. To the car's occupants the body feels absolutely flat under *all* cornering conditions, whether it's on the biting or sliding side of a drift. It feels, in short, like a good sports car.

The only defect in the ride — which digests chuckholes with typical continental gusto—is its response to cross winds. The 4CV gets pushed around considerably by side winds, and the Dauphine inherits some of this tendency. When you're traveling flat-out at 70 mph or more, a lightness enters the ride, and the need for concentration on the controls reaches a level that does not exist at lower speeds. The car can be bumped significantly off its course by gusty cross winds, and surface irregularities that normally have no meaning become factors to contend with.

However, the Dauphine's steering is instantly responsive at all speeds. Its gearing is by rack and pinion and reacts to a fingertip's pressure, although it's fitted with centering springs for pushing the front wheels back to dead-ahead aim. Although all specifications that we've seen for the Dauphine state that this steering requires 3.5 turns from lock to lock, our test car called for one turn more. But this lock is tremendous and permits a 28-ft. turning circle. The steering has the feel and behavior of a three-turn setup, and it's every bit as fast as it needs to be.

*(Continued on page 58)*

**TOP SPEED:**

| | |
|---|---|
| Two-way average | 74.5 mph |
| Fastest one-way run | 75.3 mph |

**ACCELERATION:**

| From zero to | |
|---|---|
| 30 mph | 6.7 |
| 40 mph | 11.1 |
| 50 mph | 17.8 |
| 60 mph | 30.5 |
| 70 mph | 71.0 |
| Standing ¼ mile | 24.3 |

**SPEED RANGES IN GEARS:**

| | |
|---|---|
| I | zero to indicated 25 mph |
| II | 8 (idle) to indicated 50 mph |
| III | 15 to indicated 76 mph |

**SPEEDOMETER CORRECTION:**

| Indicated | Actual |
|---|---|
| 30 | 26.5 |
| 40 | 35.8 |
| 50 | 44.8 |
| 60 | 54.0 |
| 70 | 62.5 |

**FUEL CONSUMPTION:**

| | |
|---|---|
| Hard driving | 36.5 mpg during acceleration and top speed runs. |
| Average driving (under 60 mph) | 38.0 mpg. Steady speeds under 45 mph, 49.7 mpg. |

**BRAKING EFFICIENCY:**

(10 successive emergency stops from 60 mph, just short of locking wheels)

| | |
|---|---|
| 1st stop | 60 |
| 2nd stop | 55 |
| 3rd stop | 58 |
| 4th stop | 60 |
| 5th stop | 50 |
| 6th stop | 55 |
| 7th stop | 53 |
| 8th stop | 55 |
| 9th stop | 58 |
| 10th stop | 60 |

SUMMATION: SLIGHT FADE, ALMOST IMMEDIATE RECOVERY

## SPECIFICATIONS

**POWER UNIT:**

| | |
|---|---|
| Type | In-line four, water cooled |
| Valve arrangement | Overhead, pushrod operated |
| Bore & Stroke (Engl. & Met.) | 2.28 x 3.15 ins; 58 x 80 mm. |
| Bore/Stroke Ratio | 1.38 to one |
| Displacement (Engl. & Met.) | 51.4 cu. ins.; 845 cc. |
| Compression Ratio | 7.25 to one |
| Carburetion by | One single-throat Solex |
| Max. bhp @ rpm | 32 at 4250 |
| Max. Torque @ rpm | 48.4 at 2000 |
| Battery | 6V, 75/90 ampere-hours |

**DRIVE TRAIN:**

| | |
|---|---|
| Transmission ratios I | 3.7 |
| II | 1.8 |
| III | 1.07 |
| Final drive ratio (test car) | 4.37; 4.68 to one overall top gear ratio |
| Axle torque taken by | Pivot pins (trunnions) in swing-axle U-joints |

**CHASSIS:**

| | |
|---|---|
| Wheelbase | 89.0 ins. |
| Front Tread | 49.0 ins. |
| Rear Tread | 48.0 ins. |
| Suspension, front | Coil spring, unequal length wishbones, torsion stabilizer bar |
| Suspension, rear | Independent by coil springs and swing axles |
| Shock absorbers | Double-acting tubular, front & rear |
| Steering type | Rack and pinion with centering springs |
| Steering wheel turns L to L | 4.45 |
| Turning diameter | 28 ft. |
| Brake type | Leading and trailing shoe hydraulic |
| Brake lining area | 139 sq. ins. |
| Wheel studs, circle diam. | 13 ins. |
| Tire size | 5.00 x 15 |

**GENERAL:**

| | |
|---|---|
| Length | 155 ins. |
| Width | 60 ins. |
| Height | 57 ins. |
| Weight, test car | 1430 lbs. (full fuel tank) |
| Weight distribution, F/R | 39.2/60.8 |
| Weight distribution, F/R, with driver | 41.6/58.4 (one occupant) |
| Fuel capacity—U. S. gallons | 8.4 |

**RATING FACTORS:**

| | |
|---|---|
| Bhp per cu. in. | .584 |
| Bhp per sq. in. piston area | 1.84 |
| Torque (lb-ft) per cu. in. | .942 |
| Pounds per bhp — test car | 47.6 |
| Piston speed @ 60 mph | 2090 fpm |
| Piston speed @ max bhp | 2230 fpm |
| Brake lining area per ton (test car) | 194 sq. ins. |

# SCI Technical Report:

# FIREBALL


*Ken Miles wheels through turn at Golden Gate Park race at San Francisco. Tires left large black marks the first time around, Miles thereafter followed the same tracks each trip through corner.*

PERHAPS the strangest aspect, and incidentally, the real proof of the appeal that road racing has in the U. S., is the willingness of craftsmen of modest income to match their skill in building cars to compete against the best that money can buy.

The team of Dick Trautman and Tom Barnes, of Los Angeles, are representative of the U. S. specials builders. As metal-men employed by Frank Kurtis, they are very capable craftsmen. Both have modest incomes and a long association with racing has left them without any illusions about the cost of racing and even less about the cost of building a car.

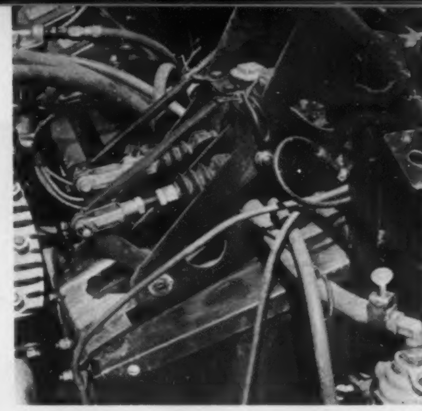
If you ask the reason for their building a special, the answer is simple and direct, "We like road racing; we wanted a car to go racing with so we built it." Since this Ford-engined special was completed in 1952, it has raced in over thirty events. Although the big win has eluded them, it has won Saturday curtain raisers, and its excellent start/finish ratio has earned it an impressive number of seconds and thirds.

The scheduled performance test on this car couldn't materialize due to the fact that the flathead coughed all its water in the main event at Pomona trying to overhaul Bill Murphy in the Kurtis Buick. However, the top speed of the car must be in the neighborhood of 140 mph with acceleration of the somewhat fierce variety.

To the initiated the Indianapolis speedway cars are, in construction detail and finish, the standard of the world for racing machinery. The Trautman-Barnes Special reflects this influence from Kurtis. From nose to tail, the car is flawlessly executed. It is impossible to find a poor weld, an out-of-round drill hole or a badly formed tube.

Of real interest in the design of this special is the way that the builders have come up with an extremely light car, 1900 pounds wet, with the extensive use of modified Ford parts.

The chassis frame is of the simple truss type but considerable ingenuity was necessary to adapt this particular form to the type of suspension used. The main tube of each side member is of round section, two inches in diameter and .083 wall. This tube runs straight back from the firewall to just aft of where it passes under the rear axle.



*Master cylinder layout for hydraulically operated clutch and brakes. Slave cylinder is mounted on side of gearbox, activates cross shaft directly.*

***By RUSS KELLY***

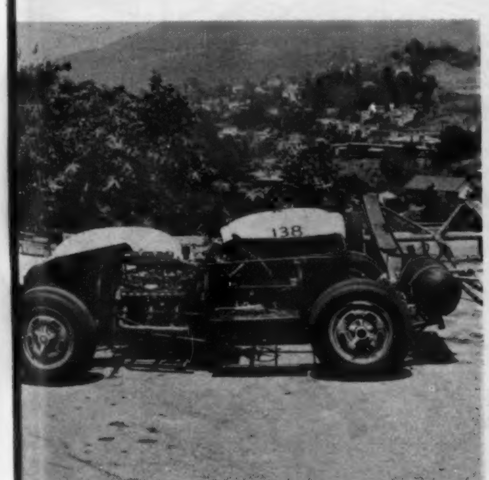
# FLATHEAD

Then it kicks up and slightly inwards. A cross-member of the same dimension tubing ties the main tubes together in the rear and carries the gas tank mounting brackets. In front of the firewall the main tube kicks inwards and upwards. The smaller side-member tube is above the main tube, making this actually an inverted truss. It picks up the main tube at the very front of the frame and follows it on a horizontal plane to the rear of the cockpit. The necessity of stopping the truss at this point because of the rear axle layout leaves the main tubes unsupported aft of the cockpit. This has been partially relieved by a bolt-in section of tubing that runs from the rear of each main tube to the cockpit frame. The small tubes used are of .750 inch section and .083 wall. Bracing between the tubes of the side members is of a triangulated pattern. Cross members are of the same section as the main side member tubes.

The unusual method of hanging the transverse springs used in the suspension also plays an important part in stiffening the chassis frame. Called "quad-pods" by Trautman, these hangers help tie the main tubes together front and rear.

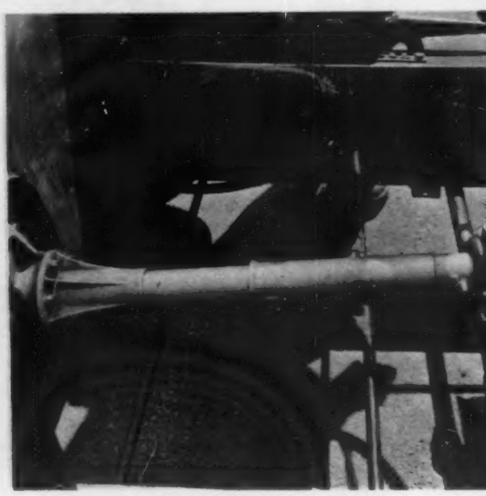
This chassis layout is obviously strong in beam and the body frame work, braced by the cockpit paneling, contributes a great deal towards torsional rigidity. The weight of the chassis frame is less than 90 pounds.

Suspension in the front is by transverse leaf spring and lower "A" frames. Most of the parts are extensively modified pre-ball-joint Ford. The "A" frames are 1949 Ford that have had a section removed to shorten them and then re-welded. The kingpin carrier and stub axle is also Ford. To obtain the proper distance between "A" frame and spring-eye, the king-pin carrier was cut off at the top and a short length of tubing welded on to accommodate the spring eye clevis bolt. The extra wide transverse leaf spring is specially made and is notable for its workmanship. Each leaf is delicately tapered at its end to guard against fracture and distributes its load evenly. The spring mount is constructed in such a manner that the height can be varied if it should be desirable to effect a weight transfer between front and rear wheels. Fifty-fifty Monroe telescopic shocks are used. The upper shock bracket is fabricated of sheet stock and is welded to the main frame tube. The lower bracket is welded to the "A" frame.

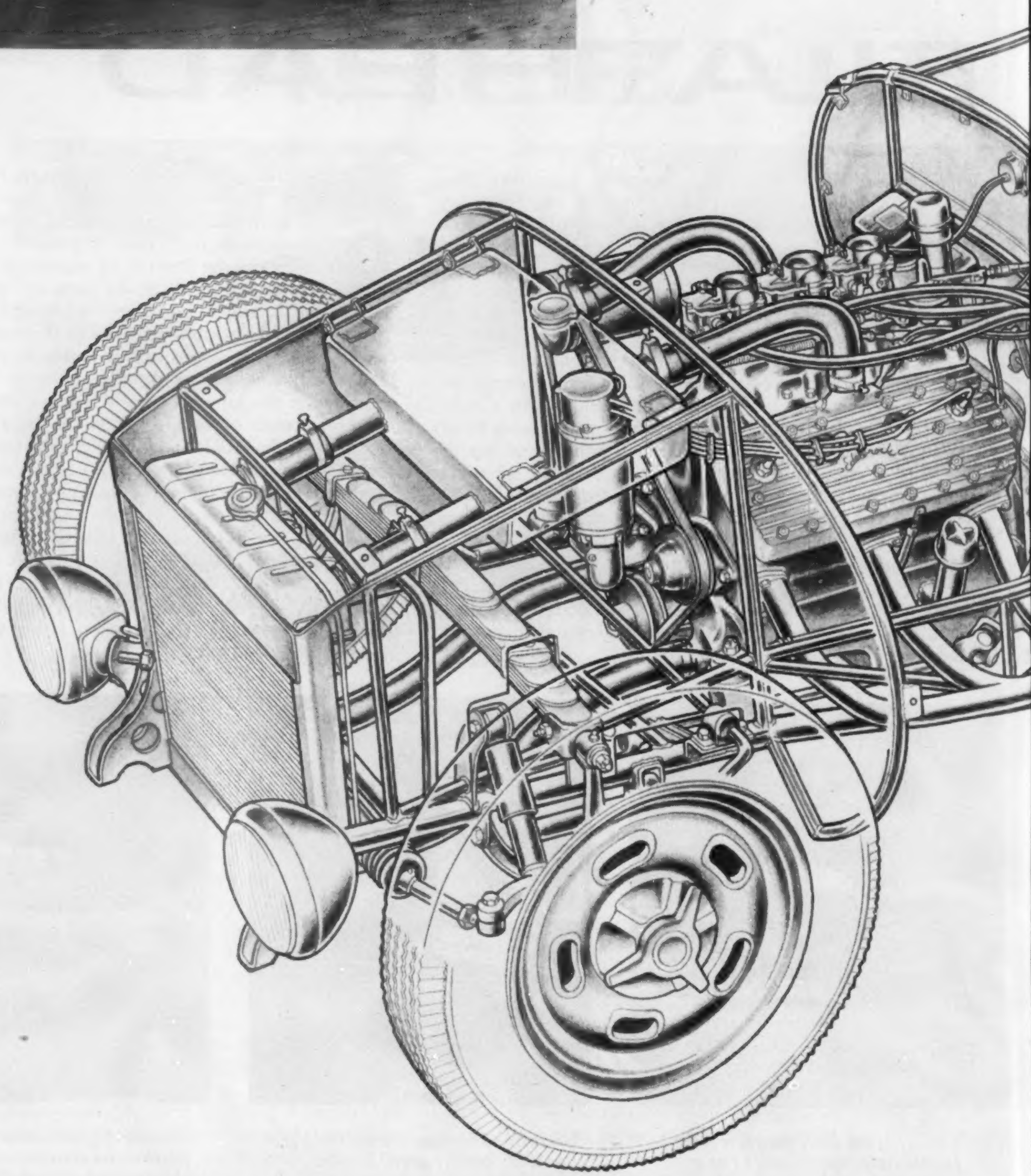



*Layout of car with panels removed. In this state, Special might be a track roadster.*

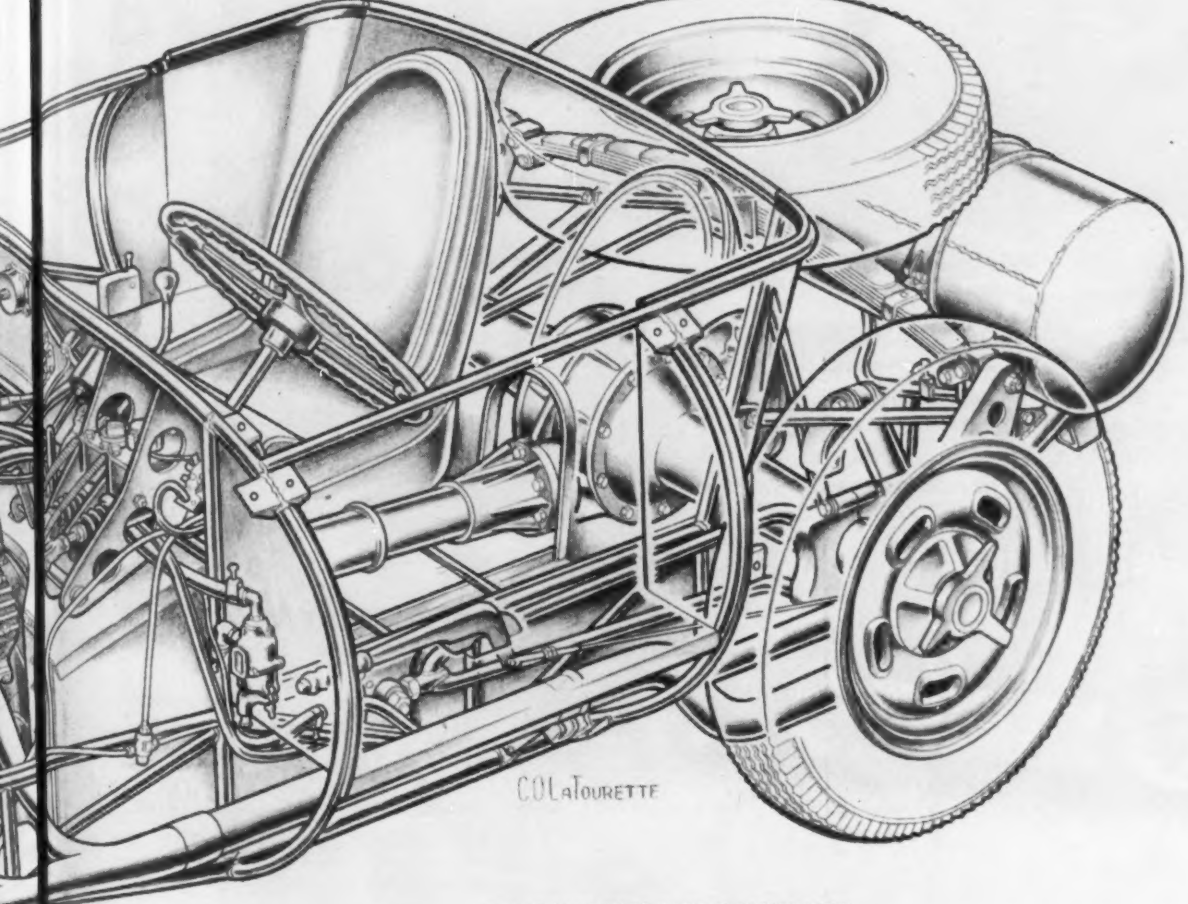
*Unfinished cockpit reveals Ford gear box with Zephyr gears. Drilled plate holds slave cylinder.*



*Rear of engine is mounted through gearbox on transverse bar. Note shortness of driveshaft.*



# Trautman Barnes Special






### TRAUTMAN-BARNES SPECIAL

### SPECIFICATIONS

**ENGINE:**

| | |
|---|---|
| Cylinders | 8 in V, 90 degrees |
| Bore and stroke | 3-5/16 in. x 4⅛ in. |
| Capacity | 283 cu. in. 4540 cc. |
| Valves | Stock Ford |
| Carburetion | 3 Stromberg 97's |
| Ignition | Joe Hunt Scintilla magneto |
| Timing | 35° BTDC |
| Plugs | Champion H10's |
| Oil capacity | 7 quarts |

**CLUTCH:**
10 inch Ray Brown Friction Master

**GEARBOX:**
Center shift Ford with Zephyr gears

**REAR AXLE:**
Halibrand-Ford quick change.
Available ratios:
3.33, 3.48, 3.62, 3.78, 3.94, 4.11, 4.30

**WHEELS:**
16 inch Halibrand cast magnesium center locking wheels

**TIRES:**
Firestone Super Sport
Size: 6.00 x 16

**BRAKES:**
Ford-Bendix Hydraulics
Front—10 x 2.50 inches
Rear—11 x 2.50 inches

**STEERING:**
MG TD rack and pinion
Turns lock to lock 1¾

**SUSPENSION:**
Transverse leaf spring and lower "A" frames front.
Transverse leaf spring solid axle rear.

| | |
|---|---|
| Shock absorbers | Monroe fifty-fifty's front<br>Gabriel Adjust-O-Matics rear |

**CHASSIS:**

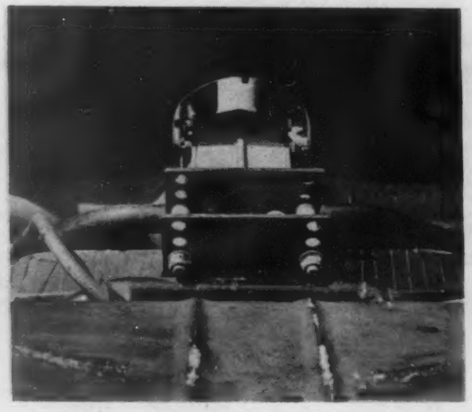
| | |
|---|---|
| Wheel base | 87 inches |
| Front track | 52½ inches |
| Rear track | 52½ inches |

**OVERALL:**

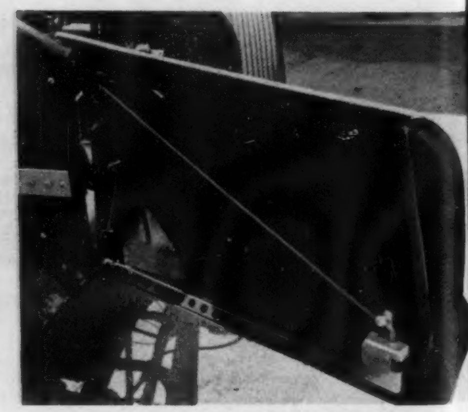
| | |
|---|---|
| Length | 145 inches |
| Width | 60 inches |
| Height | 34 inches |
| Ground clearance | 7 inches |
| Fuel capacity | 20 gallons |
| Weight | 1900 pounds |

*Chuck Daigh pushes hard to catch Bill Murphy in the Kurtis-Buick. Ford Special stayed with Murphy until engine blew up.*

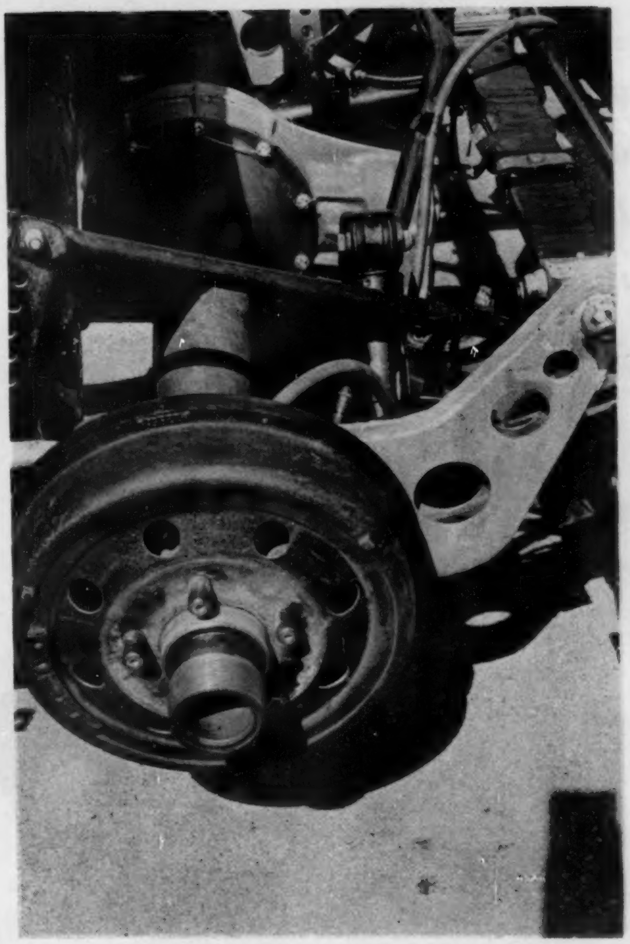

*Weight distribution was controlled by placing engine well behind front suspension.*



*Height of rear spring can be increased or lessened by selection of drilled holes in spring plates.*



*The light concave door is well braced and rigid enough to stand on. It works too.*



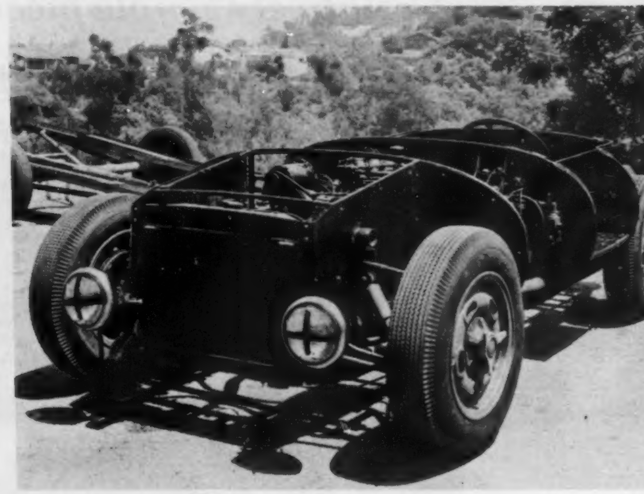
*Elongated spring perch, drilled to save weight, allows spring to be located beyond rear axle. Holes in drum exhaust air taken in by backing plate scoop.*

Steering is by MG TD rack and pinion. The track rods are also MG but they attach to Ford steering arms that have been considerably altered. In order to get the desired steering geometry with the track rods ahead of the axle center it was necessary to reverse the steering arms and bend them so that the point of attachment for trackrod to steering arm came inside the wheel between the brake drum and rim. The steering is quick by any standard, one and 3/4 turns from lock to lock and even though two universals are used between steering wheel and box, the system is absolutely without play. The stabilizer bar crosses the chassis behind the "A" frames.

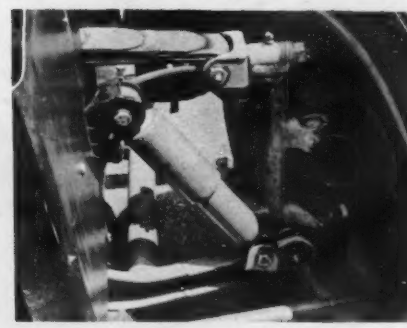
One look at the rear suspension dispels any lingering doubts about Trautman and Barnes knowing what they are doing. The builders realized that a quick change center section was a must. This meant the use of Ford final drive components. Ford final drive units are fine, but when the driveshaft is shortened, as it is with this car, suitable re-location of the radius rods can be a real problem. Stock radius rods solidly attached to the axle housing are fastened to and turn with the torque tube. Obviously, since they are solidly fixed to the axle housing, the practice of moving the radius rods out and attaching them to the chassis is asking for trouble because chassis roll in cornering will twist the housing between the radius rods and lift the inside rear wheel. The builders solved this problem by the use of floating radius rods. Tubing was welded around the axle housing at its extreme outer end and then machined as a register for a bearing incorporated in a

*(Continued on page 60)*

*Three quarter view shows sectional braces. Front wheels are zero cambered. Low placed headlights are Flord.*



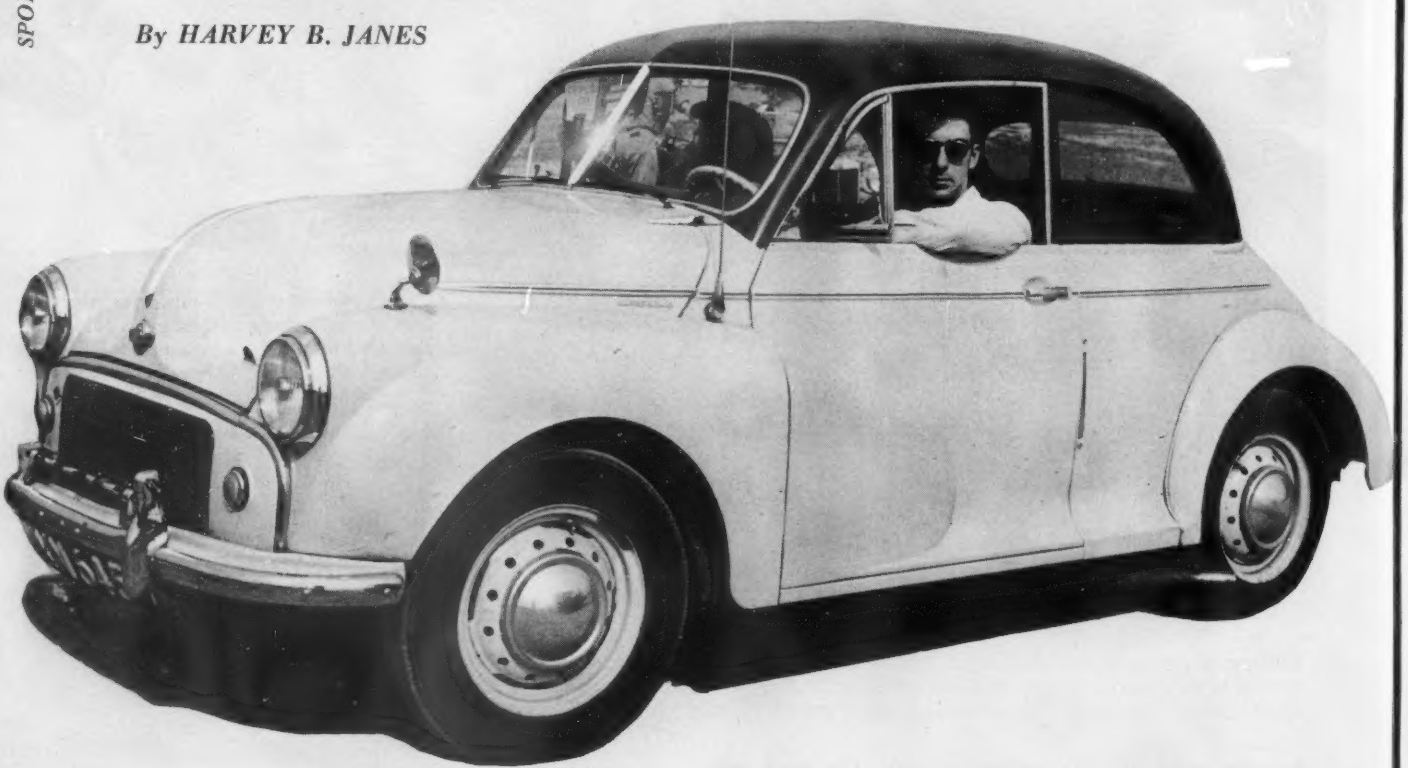
*Transverse spring acts as upper control arm. Large tubing scoops air to cool Bendix brakes. Note forward placement of steering arm.*



*Rear spring sits well behind sprint quick-change final drive. Note "quad-pod" spring hanger. Rear brakes are cooled same as front.*

***A relatively simple piece of bolt-on equipment can add 100 percent more power to the Morris Minor, turning Nuffield's Delightful Dud from a lamb into a buzzing, MG-hunting tiger.***

*By HARVEY B. JANES*



# MINOR MODIFICATION

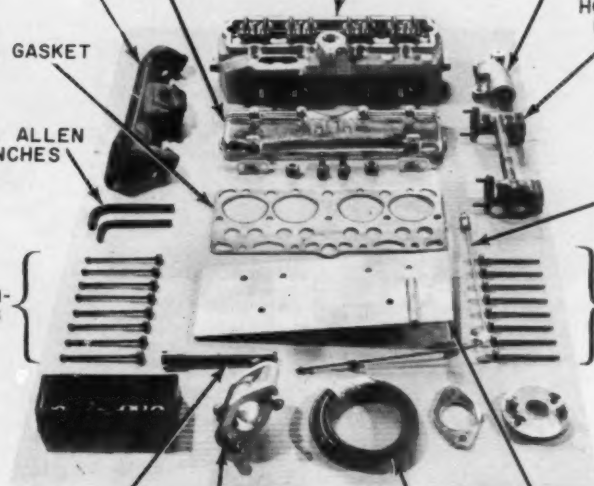
ONCE upon a time, in the days before 1953, there was a little British economy car that sold as well as the Volkswagen in the American market. This was the slow but sturdy Morris Minor flathead — an almost indestructible little buzz-bomb that looked like a squeezed-down Chevrolet and handled like a Ferrari.

Perhaps "buzz-bomb" is not the perfect term to describe the Morris flathead. It buzzes all right, but is anything but a bomb. Out of a displacement of 918 cc., the manufacturers managed to squeeze 39 lbs/ft. of torque and a rousing 27.5 horsepower at 4,400 rpm, a speed, incidentally, which the engine can attain only in the intermediate gears. As you know if you have ever driven one, all this leads to what can hardly be called performance at all, but rather a noble try.

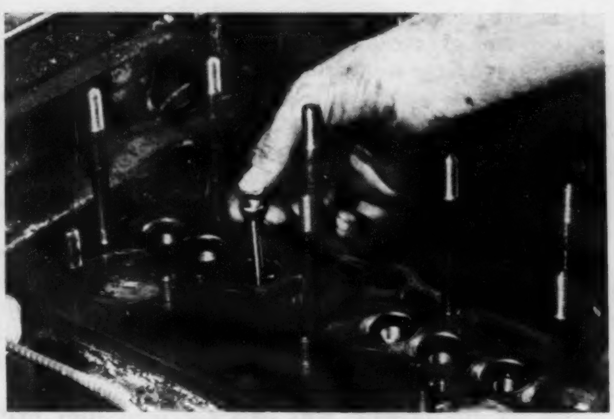
Such is the perfection of steering, suspension, gearbox and brakes, however, that thousands of Americans fell in love with the car, enthusiasts in particular. In garages and back yards all over the land various modifications were tried, with some degree of success, but the handicap of side valves proved too great to make it all worthwhile, especially since the finished product still wouldn't go over 70 mph.

Meanwhile, back across the Atlantic, the British, too, had recognized the charm of the Delightful Dud and small parts manufacturers began to design speed equipment for the Minor. In various stages of tune the cars met with considerable success in British club racing meets, and drivers like Stirling Moss and Roy Salvadori stalked the highways in highly-modified examples of the marque. It was soon learned that the Morris was, in fact, crying to be souped, and that the crankshaft, gearbox, driveline and rear axle were fully up to the talk of withstanding the additional stresses of at least 6,000 rpm, if only there was a way to achieve such revolutions.

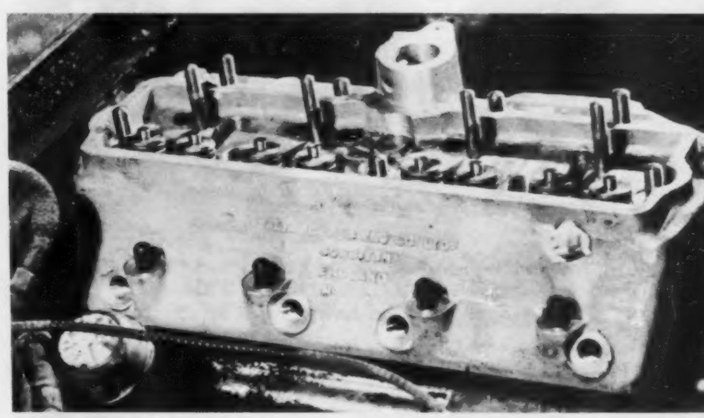
A famous British designer came to the rescue. Geoffrey Taylor, head of Alta Car and Engineering Company, pro-




*The Alta head kit as it looks taken from its wrappings. In this case the offset manifold extension and the single carburetor gasket were discarded for the home-made manifold which would accommodate the two SU carburetors already in possession of the owner.*



**1** *The eight inter-tappets from the kit are oiled and inserted through the old valve guide holes. This is done only after block is cleaned and studs set in.*



**2** *After block is wiped clean, the gasket is set in place with the black side down. The valve faces are oiled and the head is positioned over the studs.*

ducer of engines for HWM, Connaught and other British racing cars, engineered a nifty, high-performance, aluminum overhead-valve conversion head for the flathead Minor and soon went into limited production on the unit, supplying racing enthusiasts almost exclusively at first.

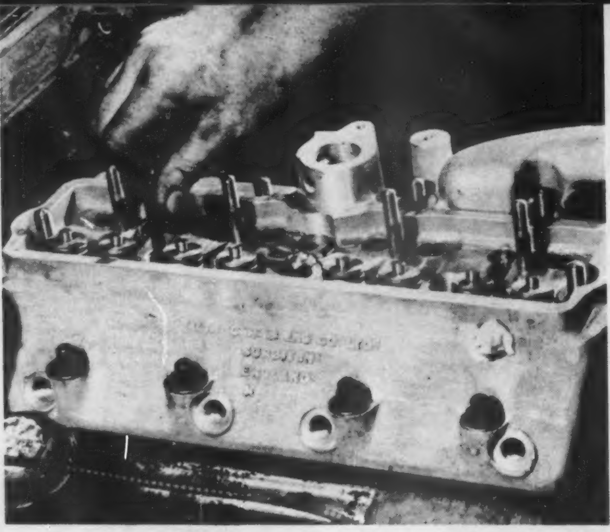
Performance of these Alta-Morris specials proved to be nothing short of amazing and more and more non-racing Morris fans began to get interested, so Taylor upped his production. Within a year he was shipping Alta heads all over the world.

As the deeds of Alta-Morrises drifted into the United States, deponent was one of those who fell. We already had a '52 flathead that had been "tuned" to the point where its performance was just about equal to that of a good stock VW, perhaps a bit better on the lower end. But torque was still a problem and we still weren't satisfied, so off went our order to Mr. Taylor.

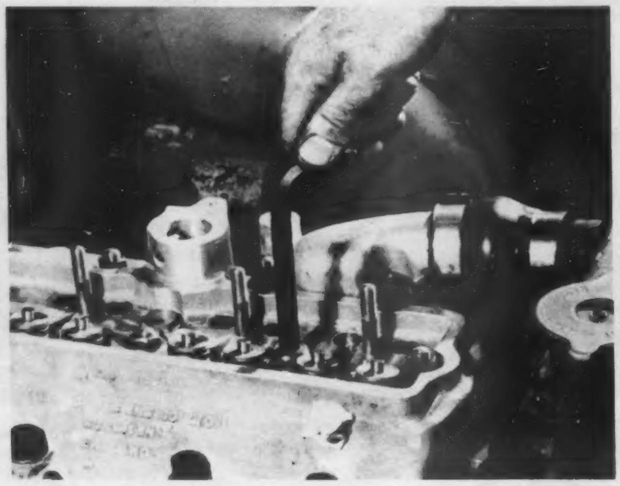
While we were waiting for the head to arrive we did some research on the availability and performance of Minors, vintage '50-'52. We found that it is not at all difficult to find a very good specimen for under $450 and that parts are no problem at all. As to performance on a strictly stock car, we borrowed one owned by a friend, put it through its paces, and got the following set of figures:

From a standing start to 30 mph we averaged 8.9 seconds. This run required a shift to second, but the synchromesh was working perfectly and we "wasted" only about a tenth of a second. Zero to 40 came to 14.1 seconds, to 50 took 21.7. Our run to 60 mph was more of a walk, consuming 38.6 seconds. Actually this figure wasn't too bad at all, considering the fact that the top speed came to just 62.7 mph.

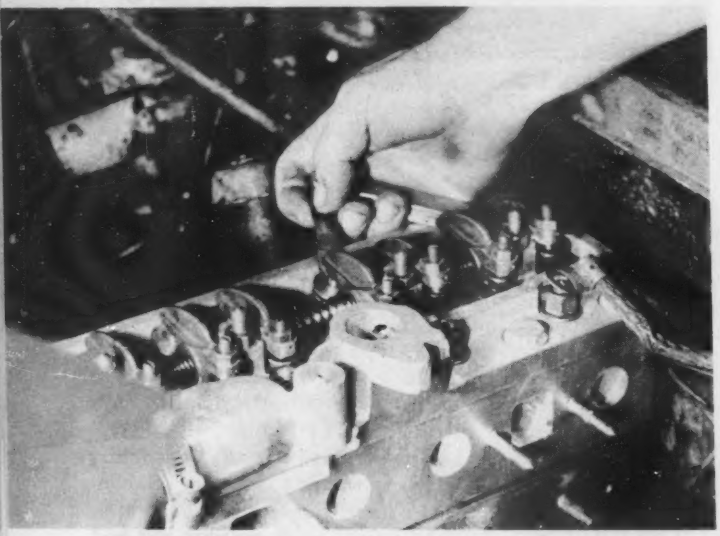
All of the original modifications work on our car had been done by a red-headed Scotsman named Jock Murray, who was star mechanic for the MG team at Sebring this year. When our Alta head came we took it, and the car, up to Performance Motors, in Haverstraw, N. Y., where Murray



*3 With washers set on studs, the two Allen bolts through the intake ports were then tightened down with a special Allen wrench supplied with the kit.*



*4 Following the procedure given with kit, the head bolts were next tightened down. To avoid warping or cracking head, uniform torque must be applied-28 ft/lbs.*



*5 The short pushrods were set above the inter-tappets and the rocker assembly was set in place over them. Side valve tappets were then adjusted to .015-.020 inch.*

is employed, to let the man complete his task.

First step was to wash the engine down completely. Kerosene and water did the trick nicely. While this was drying, Jock carefully polished the ports on the Alta head and smoothed out the valve throats, an operation that is not necessary but in this case beneficial.

Next the engine was completely dismantled, right down to the block. Cylinders were bored out to bring the total overbore to .060 inch and new, lightweight pistons, rods and bearings were installed. This step is not necessary, of course, if your car has had a recent overhaul, but keep in mind that rings and bearings must be in good shape to withstand the additional power and rpm. In fact, if you can afford it, the wisest thing is to have the engine completely balanced, statically and dynamically.

The grinding wheel should be used on the cylinder block as well as the head, matching all ports to assure maximum breathing. In our case, most of this work had been done before. The only additional work required on the block was to clean off the top face with a stiff wire brush, being careful not to get any dirt into the cylinder bores. Then the four short right hand head studs were screwed back in and we were ready to go.

The stud threads in the cylinder block and the top of the block itself were oiled and the studs supplied in the kit were screwed in place, two nuts being locked together on each stud. The two longest studs fit on the front of the block, opposite the four short original ones, and the shortest stud goes in the center of the head, being fastened in place with the short nut supplied. With all the studs inserted, the old distributor drive shaft was replaced with the new, longer one.

Next, the eight inter-tappets from the kit were oiled and inserted through the old valve guide holes. The original tappet screws were turned inward two turns at this point, but not locked up entirely. Once again the top of the cylinder block was cleaned and oiled, and a little oil was put into each cylinder. For this purpose light engine oil was used. This accomplished, the new head gasket was placed in position with the black side down and the Alta head fitted carefully in place over the studs.

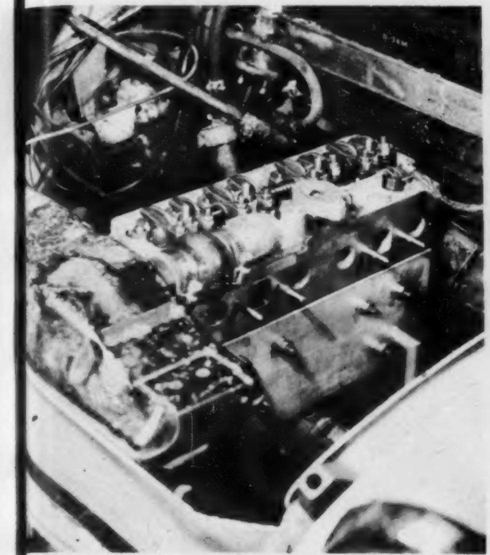
Now more oil was smeared on the nuts and with washers in place all the nuts were loosely tightened, starting with those in the center row. The two Allen bolts through the intake ports were then tightened securely with the special Allen wrench that comes with the kit. Keep this wrench! You will need it when the engine is overhauled.

Now for the delicate work. All the head nuts were tightened with a torque wrench, the correct torque being 28 ft/lbs. Do not be in a hurry here. If the head is not torqued down uniformly it will warp, or possibly even break, and all of your time and effort, not to mention money, will have been wasted. Go around the nuts several times to make sure.

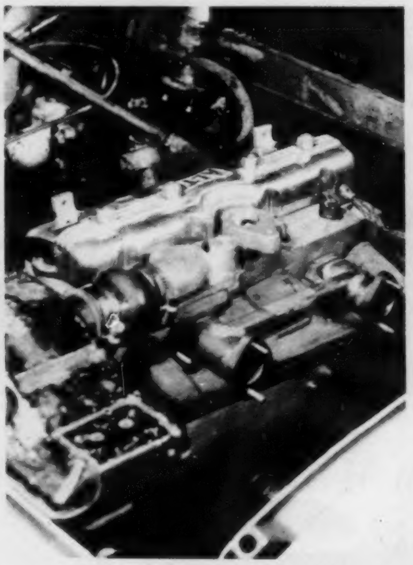
Sixteen short pushrods are supplied with the Alta kit. These were now placed in position through the valve guide holes, over the inter-tappets, and the new (and very neat) rocker assembly set in place above them. The original side-valve tappets were then adjusted to a clearance of .015-.020 inch. In this procedure, care must be taken to follow the sequence indicated in the original Morris instruction booklet. Valve number one is set with number eight fully open; three with six fully open; five with four fully open; two with seven fully open; eight with one fully open; six with three fully open; four with five fully open and number seven valve with number two fully open. Then the tappet screw nuts that were loosely tightened before are locked up, and for the last time. From this time on all valve adjustments are done from the top, making service that much easier.

But we were not yet ready to utilize the adjustment at

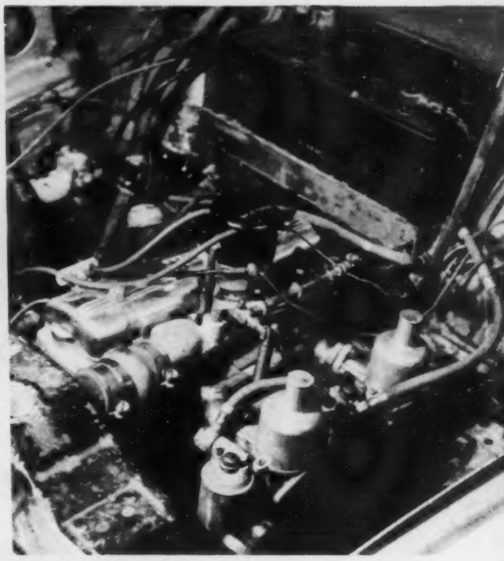
# MINOR MODIFICATION



*6 A new aluminum side plate replaces the old one, and seals off the old ports and the side tappets. Four spacers and fiber washers are supplied.*



*7 Exhaust and new home-made intake pipes were mounted along with rocker cover. Note intakes are connected by a balance tube between.*



*8 Completed, this is what the conversion looked like. Distributor now sits higher than before, and has an extension shaft, supplied with kit.*

the valve rockers. First the old side plate at the tappets was replaced by the new aluminum one, using the four spacers and fiber washers supplied, and the breather pipe was connected to the short, bent pipe leading from the plate. Then, using two wrenches, one against the other, the two bolts at either end of the rocker shaft were thoroughly tightened.

At this point the intake-exhaust manifold would be fitted in place, if it were going to be left intact. We had decided to use two 1⅛-inch S.U. carburetors instead of the one normally employed, however, and this meant that a new intake manifold would be needed. The problem was solved simply and efficiently. The intake branch of the old compound manifold was sawed off and discarded. At either end, where the cut was made, the exhaust manifold was sealed off, making this a separate unit. Then a new intake manifold was fabricated. This consisted of two short pipes, each with a flange for mounting one carburetor, connected by a balance pipe. Thus, the manifolds were now separate and yet they fit on the side of the head exactly as would be the combined stock head, matching the ports exactly. You may not want to go into the expense of such a conversion, especially since an S.U. carburetor alone costs about $35, but the difference in power output is gratifying.

Once our manifolds were completed, they were immediately mounted and attention was turned to the valve gear. Some light oil was poured over the rocker assembly and a little more was used to coat the valve cover gasket. This was then set in place and the beautiful, finned aluminum cover itself was mounted on top and fastened with the four brass bolts supplied with the kit. We were in the home stretch.

The distributor was throughly cleaned and oiled, and new points were fitted, adjusted to a clearance of .012 inch. After the new plug leads had been attached, the two small, plastic high tension wire holders were fastened to the brackets on the side of the valve cover, opposite the distributor drive shaft. The leads were then threaded through these holders and the distributor itself was mounted in place. Our original lead ends were fitted, as were four Champion NA-8 spark plugs, gapped to .020 inch. Other plugs that may be used with the Alta head are Lodge CLN-H and KLG FE-50.

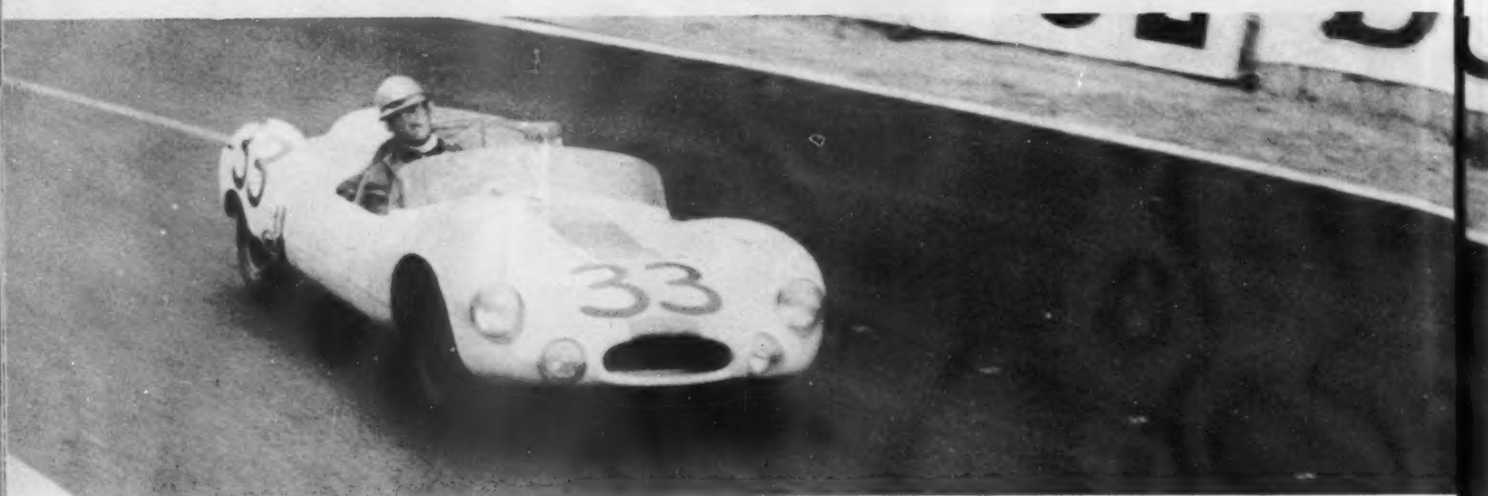
Ignition timing was painstakingly adjusted with the use of a timing light. The correct timing is the same as with the stock Morris. Then the bolt on the front camshaft bearing (on the front, left side of the block) was replaced with one end of the thin, flexible oil line provided. This is the oil supply for the valve gear, and the line was carefully bent, to avoid kinking, until the other end would fit easily into the tapped hole on the front, right side of the cylinder head, passing in front of the head and above a small, centrally-placed lug. The oil line was attached to this lug by means of a clip and set screw.

There is an exhaust manifold extension included in the Alta kit. This was bolted to the manifold flange with an asbestos gasket in between. Instead of replacing the old muffler and pipes, which were shot and which created too much back-pressure anyway, we installed a replacement Huth muffler and pipes, made specifically for the flathead Minor.

Now we were ready for the carburetors. The existing one was dismantled and thoroughly cleaned and both were fitted with richer-than-stock M 9 needles (one of these is supplied in the kit). In inserting the new needles, care must be taken to keep the shoulder of the needle level with the face of the sliding piston in the carburetor. Make sure to refill the carburetor dashpots with light engine oil.

*(Continued on page 61)*

# The Bob-Tailed Bomb



*Author in the Bentley-Hugus Cooper Climax at Tertre Rouge. Light rain made circuit hazardous.*

*by JOHN BENTLEY*

"Un pilote", at Le Mans, is a driver who for no reason at all elects to drive an automobile very fast around the classic Sarthe Circuit for as long a portion of 24 hours as he can stay on the road or keep the wheels turning. The urge to meet this grueling challenge is a strange phenomenon. It is useless to ask a driver why for 24 years he and his predecessors have "diced" their way through the mad scramble of the Le Mans start, into the late afternoon and the glare of a summer sunset that throws a blinding screen of molten copper over the tricky Indianapolis and Arnage turns; and have defied the confusing shadows of waning day and highballed through the downpours, the mist and fog of an unpredictable night until the pale dawn of another day slowly rises to greet them. Then, tired, dirty and half-hypnotized, have pressed on into the following afternoon until at last – at long last – the checkered flag greets the survivors. "Un pilote" simply knows that it is the most intensely exciting and dramatic experience he can undergo.

At any rate, when I was in England last March and John Cooper offered me a ride on the official Cooper team at Le Mans, Ed Hugus and I decided to take a crack at it. It was something we had long wanted to do; more important, something both of us believed we could carry through to a successful finish – given any luck. The team consisted of two cars; our 1100 machine and the new 1500 model with the bored and stroked Coventry-Climax engine. At the last moment, however, Cooper was unable to obtain a 1500 engine and we found ourselves alone against two specially built and formidable Lotuses, an 1100 Osca-engined R. B. (Py and Dommée) and an 850 cc V. P. machine with a Panhard engine driven engine by Dumazer and Campion. Since neither the R. B. nor the V. P. offered any serious threat, the Class G battle involved our Cooper and the Allison-Hall and Bicknell-Jopp Lotuses. On Index—no illusions. The issue lay somewhere between the DB-Panhards, the two phenomenal new Porsche coupes and possibly the remarkable 1500 Lotus of Chapman and Fraser which in practice circulated at close on 100 mph. The 1956 fueling regulations restricting gas capacity to 130 liters (34.3 US gallons) on which at least 34 laps (283.3 miles) had to be covered, with subsequent refueling limited to 120 liters (31.7 US gallons) did not favor the big cars. Their drivers had to run strictly to predetermined rev. limits to save gas.

John Cooper had done a fine job converting the "monoposto" frame of the Cooper to meet the new Le Mans ruling which calls for two usable seats 20 inches wide. "Over a pint of beer," as he put it, John got rid of the upper longitudinal members and replaced them with a center tube under tension. He added some ingenious bracing to strengthen the frame behind the seats, moved the steering wheel to the right and put the shift lever in the center. The car also had a full-width windshield complete with wiper blade, but as the top of the windshield came level with our chins, it was merely a token affair that soon caked solid with mud. Other modifications included an oil cooler and the 1500 clutch installed to cope with the 87 bhp (at 7,000 rpm) of the Mark II Coventry-Climax engine. We thought the 3.64 axle low for Le Mans, but Cooper was right. This ratio gave us 21.15 mph per 1,000 rpm in fourth and we could just hit 6,000 (with tire expansion nearly 132 mph) towards the end of the four-mile Mulsanne Straight. The Lotuses were lower-geared and their acceleration was superior, but they had to turn well over 7,000 rpm to equal our lap speeds – and 24 hours is a long time. With odds of two to one against us, our ratio appeared more suitable and in practice we kept the revs around 6,000 through gears to give the engine a chance to settle down. Our practice lap times were

# and The 1440 Minutes

***There's only one way to see the real Le Mans — from the bucket of a race car. Here is the log of the only American entry in the 1956 24 Heures Du Mans***

*Sun brightens morning after an all night rain. Flockhart in the winning D-type Jag barrels through turn at White House on way to victory.*

appreciably slower in consequence, and while our watches caught the opposing team well extended with laps of 5:07 and 5:08 (94.98 mph) they had no idea of what we could do.

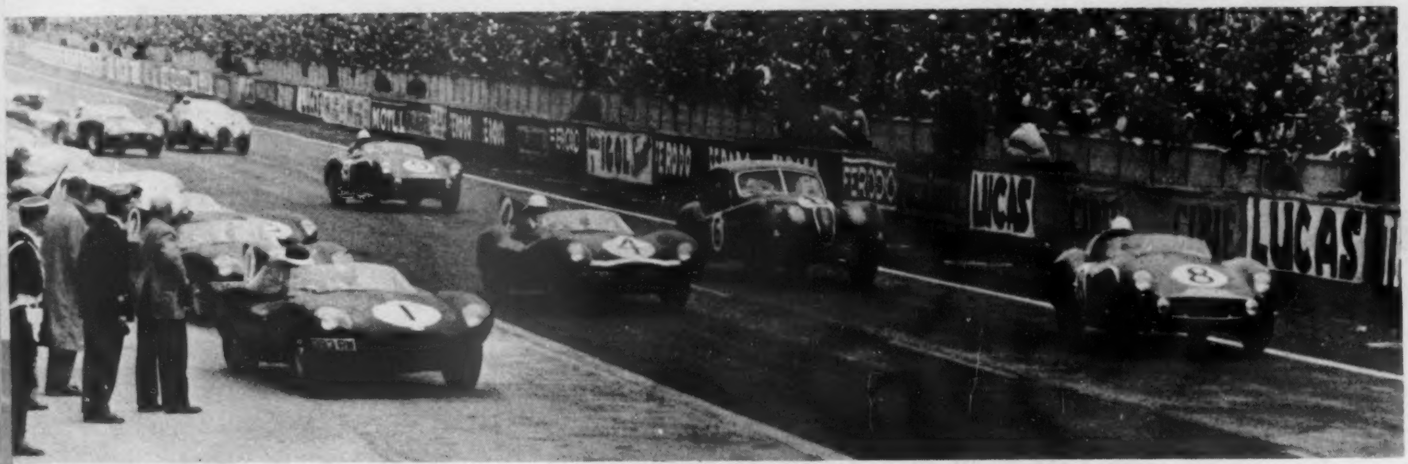
The story of the 24-Hour race as seen from our pit and over the top of No. 33 Cooper's muddy windshield presents such a complex and humid pattern (it rained for about 20 hours) that it is best told in log form.

SATURDAY, JULY 28 – 1 pm: Dropped P. D. (Parker Davis) and Stan Nowak, two of our crew, at Mulsanne Corner pit where all signals must be given. Their cubby-hole is like South Sea Island hut with rattan walls, and a packed earth floor. They are linked by phone with main pit but otherwise marooned for 24 hours. Left them chaise lounge, food and crate of Evian water. Poor guys are in for a rough time as we can't spare any relief.

2 pm: Our pit Commissar, an impatient type, made us line up on pit counter every tool, part, nut and bolt we are carrying in car. Check form filled in triplicate. Sealing of gas tanks presents major problem. Commissar insists gas caps must be sealed – not trap doors of body. Says we can reach gas caps by loosening five Dzus fasteners; body seals therefore useless. This means at least two minutes wasted at each refueling stop while Commissar fumbles with wire and seals in narrow opening giving access to gas caps.

2:30 pm: Inspection and sealing completed. Spotless Cooper, bearing blue and white American colors looks fine, parked diagonally in front of pit. Crowds milling around. Pit straight like Fifth Avenue on Easter Parade morning. Our crew consists of John Cooper, chief; namesake John "Court" Cooper, mechanic; Joan Hallock, stopwatches; Lucille Davis and Dixie Nowak, spotters; Flight-Lieutenant Bill Lamb, and RAF jet pilot and slide-rule wizard, chart-


*The checkered flag is about to fall on the Frankenberg-Von Trips Porsche marking it winner in the 1½ litre class.*




*They're off! Number 8, Moss-Aston-Martin, led the field, but Hawthorn in number 1 overtook the Aston by the end of the first lap, and set the pace until fuel injection trouble forced a pit stop. The Walker Aston then led briefly.*

*The Aston Martin pit early Sunday morning—raining hard. The 2.5 prototype is in for a routine stop as Reg Parnell waits at right to take over.*


*Sandwiched between a Gordini and the Gendebien-Trintignant Ferrari the manx tailed Cooper keeps an easy pace around turn.*

keeper; Pat Vanson, an Englishman living in Paris (also fluent with lingo) in charge of refueling pump.

**4 pm:** They're off! Scrambled patter of crêpe soles. Whirr of starters. Crowd of 200,000 exhales with a wild yell that almost drowns explosive snarl of engines. Moss (Aston-Martin) first away as usual; but when howling pack completes first lap, Hawthorn's D-Jag leads, followed by Moss, Flockhart (D-Jag), Walker (Aston-Martin), Frère and Fairman (D-Jags) and de Portago's Ferrari. Seconds after they vanish around Dunlop Bridge Curve – spectacular crack-up. Frère spins in the slippery Esses, wrecking Jag. Fairman slithers clear of team mate but de Portago bangs into him. All three machines, including two of three works Jags, are out. Ed motors Cooper smooth and steady, working way up field behind two Lotuses. Time for 10th lap: 5:27.3 – 89.3 mph. Bicknell-Jopp Lotus No. 36 heads class; only seconds separate three cars. Rain has stopped; track drying.

**6:27 pm:** Ed's 27th lap is fastest in 5:06 – 95.29 mph. He's found "groove." Glancing over Bill Lamb's battered hat as he squats in pit corner with slide rule, I see Cooper was officially timed through Flying Kilometer at 120.46 mph on 25th lap. Bill's chart is a dizzying thing of sheer genius. Besides recording time for each lap, it shows progressive time, Index time, difference between two, lap speeds, cumulative race average, position in class, overall and on Index, plus columns for pit stop details and running log. Our Index figure has climbed from 1.08 on lap 5 to 1.17, but John Cooper thinks we're going too fast, too soon. He's about to call Mulsanne to put out SLO signal when downpour starts. That does it. Ed eases off to 5:33, then 5:53 and all's well. Leaders: 1. Moss-Collins Aston; 2. Flockhart-Sanderson "Ecurie Ecosse" Jag; 3. Walker-Salvadori, Aston. Hawthorn, in and out of pits with fuel injection trouble, many laps behind. Henry's 4th lap crash in No. 51 Panhard at White House unfortunately proved fatal. Only two days ago we were talking to him at Hippodrome Cafe.

**7:11 pm:** Phone rings from Mulsanne on 36th lap – one before Ed is due in. Cooper leaps from pit counter to phone. "The car's hit the sandbank at our corner," P. D. tells him. "Don't know how deep in he is." All our hopes buried in a sandbank? No one speaks for three minutes until phone rings again. "Ed's digging himself out," P. D. says. "Nothing serious. He'll soon be on his way." Pity we coudn't make a tape recording of our collective sigh of relief. Lap 36 costs Ed 10:11 before he comes by, but no visible damage.

**7:27 pm:** Cooper in and so is downpour, seemingly for good. I stand on pit counter ready to jump in when refuel-


*Cooper in for a routine pit stop is about to roar out with Bentley behind wheel. Ed Hugus is in pits giving latest road conditions, and hazards to refreshed driver. Time: noon Sunday; condition: dry road; lap times: fast.*

ing completed. Used 51 liters of gas; half pint of oil. Averaged 24.7 mpg. Pretty good. "It's slippery out there," Ed grins at me through his vizor. "Take it easy." John and "Court" Cooper work like beavers but tank sealing takes forever. Move out after 3:54 pit stop. Brother, is it wet! Through Esses, Frères No. 2 D-Jag stands battered and forlorn at right; on outside of left loops stands the Zehender-Lucas Talbot No. 18, also clobbered and abandoned. It spun half an hour ago. Cooper rides fine along Mulsanne despite high tire pressures recommended by Dunlop which were *not* for rain: 40 lbs rear, 35 front. Standing lap in 6:00; Stan and P. D. grin at me as I inch around tight and nasty Mulsanne Corner past their pit. P. D. wears red cap, Stan a checker job. Despite downpour, see signal board clearly. As I get "groove," time drops to 5:28. That's better than 88 mph average. "OK" sign comes up. Around lap 45, catch and pass Lotus No. 35 along Mulsanne. We move into second place. Don't see him any more. Lap 49, cut off too deep at Mulsanne. Realize at No. 1 marker I'll never make narrow right. Use escape road, do a loop and get back on course. Boys clap with joyous irony; that lap takes 4:48. Serves me right.

**9:20 pm:** Dusk sets in early and darkness comes quickly due to heavy overcast and continuous rain. Switch on headlights — and can't see a thing. Right light is cocked skyward, left also out of focus, creating mass of confusing shadows that add to rain problems. Can't figure it out. Lucas set lights during night practice. Then I get it. Ed's trip into sandbank bent body front out of shape. Gets harder all the time to maintain laps between 5:30 and 5:40, fast left-right kinks between Arnage and downhill section to White House zig-zag become a menace. Four wrecks partially block road, one of them blazing. No. 21 Meyrat-Tavano Ferrari spun out of White House and No. 26 Porsche coupe of Nathan-Glockier crashed into it and overturned, catching fire. No. 52 Stanguellini (Faure-Foury) hit Porsche and No. 50 Panhard of Chancel-Beaulieu piled into wreckage. No one seriously hurt but heat of burning Porsche is like blast furnace. Brings back memories of that terrible crash last year. On lap 72, with two to go before stop, take Dunlop Bridge Curve at 110 mph and nearly come to grief as Cooper starts crazy slide towards apex. Next lap, treat Dunlop Bridge with more respect but shift too far downhill to Esses and can't quite make left curve. Slide into wrecked Talbot and bounce off with nasty crunch, smashing recognition light but escaping disaster. Enough for now.

**11:13 pm:** Pull in on 74th lap for refuel and driver change. Take in 55 liters gas, two pints oil, a little water. Only body damage to Cooper. Gas consumption: 25.6 mpg. We're now leading both Lotuses, or as a British magazine later puts it with injured pride, we have "somehow managed to get by" our two rivals. Index position, 5th; overall, 16th. Twelve cars have dropped out. Dixie hands me cup of coffee; go off to take hot shower (100 francs) with soap (25 francs) and towel (free), then change into dry clothes. Bill Lamb still squats like Buddha over charts, figuring away to three decimals. He's seen nothing of race. It's pouring rain. Driving conditions and miserable lights are reflected in lap times: fastest, 5:38. John Cooper, cheerful, tireless as ever. Our crew at Mulsanne holding out like stalwarts. Feel guilty thinking about them when I slip over to hospitable Lucas' balcony for hot "cupper." Heaps of cold meat and chicken in our pit but no bread. P. D. and Stan have all the bread at Mulsanne. Relax on air mattress but sleep

*(Continued on page 63)*

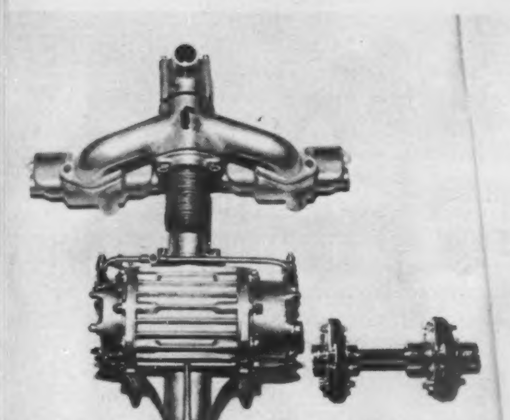
*Tony Brooks, fresh out of the hospital after the Silverstone accident, corners in the 2.5 Aston. Car went out 10:00 A.M. Sunday with broken rear.*

*The 1500 cc winner, Porsche number 25 of Von Trips and Frankenberg takes the graveyard turn at the entrance to White House.*

# Supercharging III

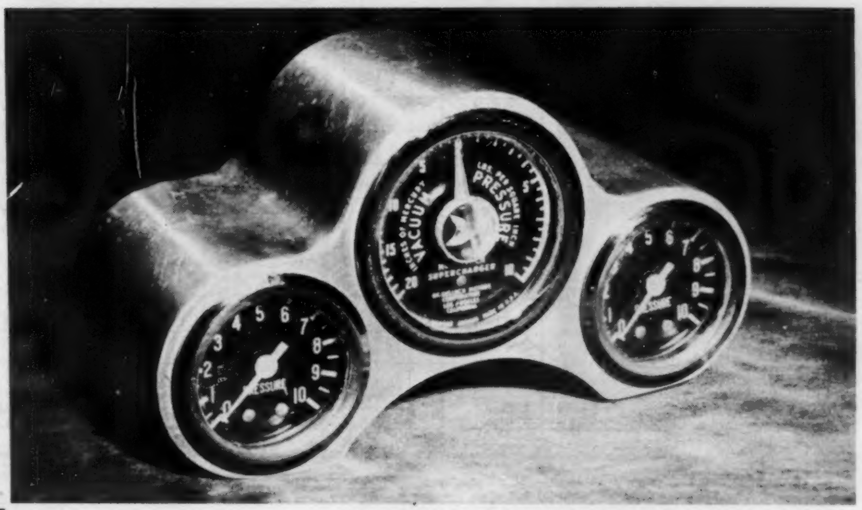
## *Tuning up for pressure*

*An early McCulloch installation on a '54 Olds with pressurized carburetor adaptor.*



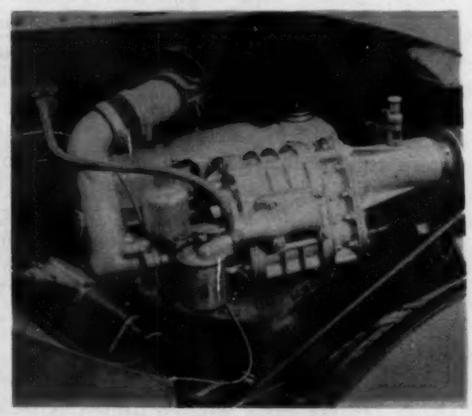
*The Roots blower, drive shaft, and manifolding of a Grand Prix 35C Bugatti. Spring loaded discs absorb shock loads.*

*By ROGER HUNTINGTON*




*McCulloch instrument cluster designed to clamp on T-Bird steering column. Cluster can be inverted for an under-dash mount.*

*LEFT: A 180 Offy with centrifugal blower uses 4 Amals. Plenty of carburetion is a must. Small amount of fuel is injected into incoming air to cool delivered charge.*



*Though guess work and figuring can be easily eliminated by buying kits for specific cars, safety margins cut the potentiality of forced induction. This is a Marshall-Nordec on MG TD.*

Bolt-on automotive superchargers are usually driven by V-belts, though many "integral" installations have successfully used gear and chain drives. At any rate, intelligently engineering a blower drive system using any of the three transmission mediums is apt to be a pretty hit-and-miss proposition because we're usually working with horsepower factors and pitch-line velocities that are strictly "off the scale" in terms of compact industrial drives. The average machinist would throw up his hands in horror if you told him you wanted to transmit 80 hp at 12,000 rpm with a light, compact chain drive. Design data on industrial drives that are expected to run for thousands of hours without attention just don't extend into these regions. We're just going to have to extrapolate known data by "guesstimating" as best we can, and hope for the best.

Another unusual problem: high positive and negative acceleration rates, particularly with centrifugal blowers. Flex coupling, like coils in clutch or torsional shaft can help.

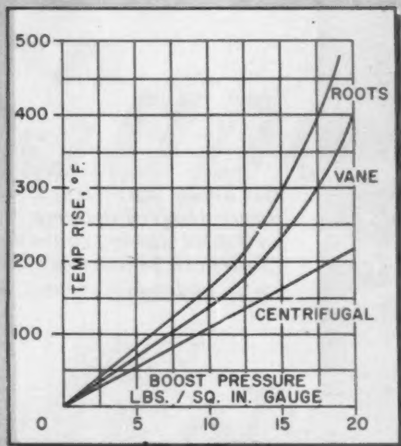
Before we get into specific drive problems, though, here is a list of approximate blower horsepower requirements that we're going to have to design for:

McCulloch, 50-150 hp engine, 6 lbs.................6-12 hp
McCulloch, 150-300 hp eng., 5 lbs...................12-20
Large centrifugal for 500 hp eng., 10 lbs.......70
Typical Roots, 90-150 hp eng., 6 lbs.............7-20
Typical Roots, 150-300 hp eng., 6 lbs.............20-35
Medium Roots for 150 hp comp. eng., 12 lbs..35
Large Roots for 350 hp comp. eng., 12 lbs.....100
Vane-type, 50-150 hp engine, 6 lbs.................7-17
Vane for small 100 comp. eng., 20 lbs.............30

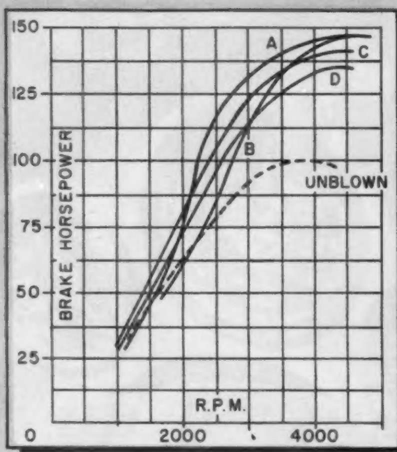
## GEAR DRIVES

A gear drive is probably the most rugged and trouble-free layout you can use—though it takes a machinist to set one up, and even he can goof if sealing and lubrication aren't right. For raw material here you can generally scrounge usable gearsets out of junkyards or used parts houses—engine timing gears, transmission gears, truck drive line gears, machine tool gears, etc.

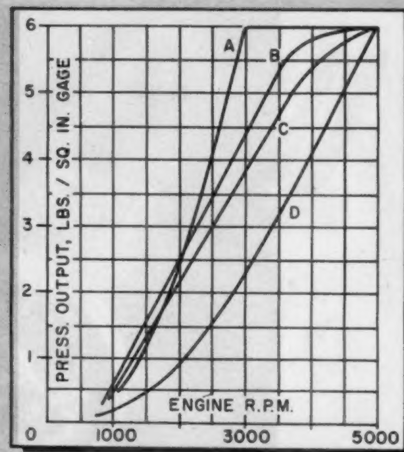
The horsepower that a given gear can safely transmit is roughly proportional to the square of its pitch diameter (diameter at the line where the teeth contact), the rpm of the gear, and the width of the tooth faces. A four-inch out-




*Approximate intake air temperature rise produced by the three types of superchargers at various boost pressures.*




*Horsepower curves: A. McCulloch centrifugal, variable ratio; B. fixed ratio; C. Vane type, fixed ratio; D. Roots type, fixed ratio.*




*Pressure output curves: A. McCulloch, variable ratio; B. Vane-type, fixed ratio; C. Roots-type, fixed ratio; D. Centrifugal, fixed ratio.*

side diameter gear with one-inch face width, even a gear of very low quality, is good for at least 10 hp at 5000 rpm, continuous capacity. A good hardened steel gear of this size can handle 50-60 hp. Gear capacity in itself should not be a problem in the power and rpm ranges we're working with. However, to keep pitch line velocity to a minimum, always use the smallest diameter consistent with strength requirements.

Some form of positive lubrication with engine oil should always be provided. You can easily bleed off the engine pressure system, with an orifice or restriction to control the flow volume. One hint: don't direct a big, fat jet of oil right into the point where the teeth go into mesh; too much oil at this point has been known to wreck gears, due to pressure at point of contact. It's better to introduce it where they go out of mesh on the other side.

Incidentally, gear ratios (and chain drive ratios) are figured according to the relative number of teeth in mesh. For instance, 52 teeth on the drive wheel and, say, 17 teeth on the driven wheel would give a step-up of $52/17 = 3.06:1$.

**SUPERCHARGER DIRECTORY**

**CENTRIFUGAL**

***McCulloch***
**Paxton Products**
**827 W. Olive Street**
**Inglewood, California**

**ROOTS**

***GMC***
**Detroit Diesel Engine Div.**
**General Motors Corp.**
**Detroit 28, Michigan**

**Jack McAfee Motors**
**13323 Ventura Blvd.**
**Sherman Oaks, Calif.**

**SpeedoMotive**
**9712 S. Garvey Blvd.**
**El Monte, Calif.**

***Borg-Warner***
**Miehle-Dexter Superchargers**
**100 Fourth Street**
**Racine, Wisconsin**

***Pepco***
**Pepco, Inc.**
**647 W. South Street**
**Akron, Ohio**

***Marshall-Nordec***
***Speedsport***
**4868 Milwaukee Avenue**
**Chicago 30, Illinois**

***Wade***
**Wade Engineering, Ltd.**
**Gatwick Airport, Horley**
**Surrey, England**

**VANE**

***Judson***
**Judson Research & Mfg. Co.**
**Conshohocken, Pa.**

***Shorrock***
**Autocessories, Ltd. (Arnolt)**
**Warsaw, Indiana**

## CHAIN DRIVES

The motorcycle field has been responsible for the development of some very efficient and powerful chain designs. They can handle high horsepower loads at very high linear chain speeds without falling apart if the lubrication gets a little hazy. For power requirements under about 30 hp and rpm's under maybe 5500, a large number of chain types and layouts will work—engine timing chains of various types, industrial machine drives, and any type of motorcycle chain.

For very high-speed and high-horsepower work, the weight and size of a chain should always be kept at a minimum—consistent with capacity consideration—because of centrifugal stresses and impact loading on the sprocket teeth. For severe conditions, chain manufacturers have special lightweight chain designs available . . . hardened, high-tensile steel. They're noisy and expensive, but they get the job done. A good, high-quality Reynolds or Diamond high-capacity motorcycle chain—5/8 of an inch pitch between rollers and 3/8 of an inch roller width—will pull at least 75 hp at a linear chain speed of over 7000 ft./min. (That would be equal to 6700 rpm on a four inch sprocket.

The more lubrication, the better for a chain drive, though chains can get along without oil better than gears. Getting the chain partially down in an oil bath for part of its travel is good, but not neccessary. Oil jet lubrication with the chain enclosed—or even drip feed—will suffice for most applications. Always feed oil on the inside of the chain, so centrifugal force will pull it around the rollers. If your power demands are light and you don't want to bother with a steady oil feed, periodic oiling may do. A couple of words of caution: Always have at least 15 teeth in any sprocket carrying more than a few hp, and use a spring-loaded idler sprocket to control chain whip in high rpm rigs. And never trust

a "wonder" chain too far . . . always provide a good, stout chain guard!

### BELT DRIVES

The V-belt drive is the cheapest and simplest to rig—and by using multiple belts we can handle fairly high horsepower loads. There are three standard SAE belt sizes of interest here—A, B, and C sizes, with nominal widths of $\frac{1}{2}$ inch, $\frac{21}{32}$ of an inch, and $\frac{7}{8}$ of an inch respectively. Horsepower capacity increases with pulley (or "sheave") diameter and belt speed; but here again we must keep diameter and speeds to a minimum because of centrifugal forces. This tends to pull the belt out of the groove and start it slipping. We should avoid belt speeds in excess of 8000 ft. per minute if possible (that would be equivalent to 5100 rpm on a six inch sheave).

Anyway, assuming a belt speed of 7000 rpm and 6 inch sheave diameter, a single belt in the A size will safely pull about six hp; the B size should handle eight hp; and the C size about 14. You can boost these ratings 50 percent running under borderline conditions, especially if you use the rayon-cord-reinforced "heavy-duty" types. Apparently, the modified C belt (cog-type) that McCulloch supplies with their kits can handle their 18-20 hp very nicely at up to 9000 fpm belt speed.

The small, narrow wedge V-belts that are now used for the fan and generator drives of most cars are not suitable for a blower drive. They'll handle about 10 hp per belt on a steady load . . . but they're very prone to snap under shock loads, such as you get with a geared-up blower drive. An interesting new belt possiblity would be the flat toothed Gilmer "timing" belt, presently manufactured by U.S. Rubber. These belts are rated for 17 hp per inch of belt width at 6500 fpm belt speed. I understand these new timing belts can be operated at linear speeds up to 15,000 fpm—or 8500 rpm on a seven inch wheel, with no slip.

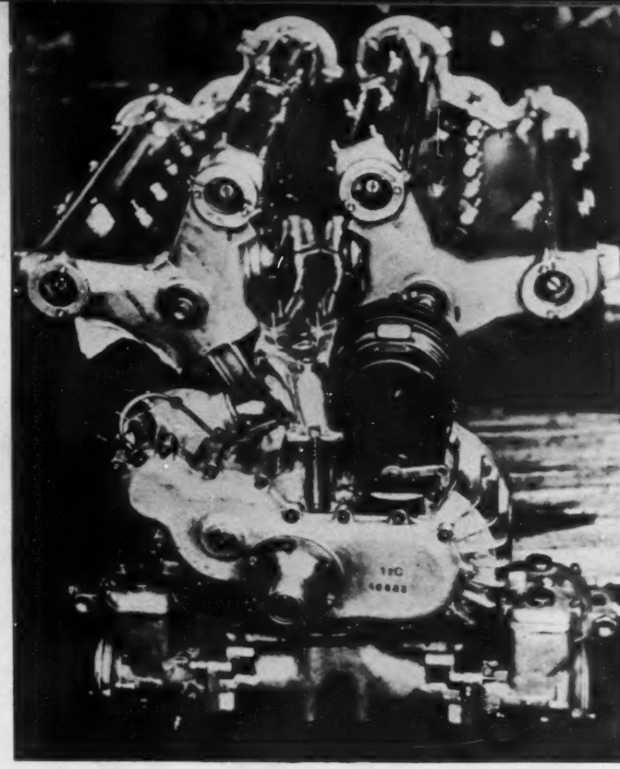
A couple of hints on V-belt setups: For very high rpm applications cast iron sheaves are apt to explode; machined steel sheaves are a lot safer for rotational speeds over 6000-7000 rpm. Always use high-quality, heavy-duty belts. If possible, don't lay out belting so that the arc of belt contact on any one sheave is less than 120° (otherwise horsepower capacity takes a nosedive). A spring-loaded idler pulley is almost a must with any V-belt drive, to compensate for stretch and to keep the belts down in the grooves. A tension of 30 or 40 lbs. is not too much on the idler.

And a word about calculating sheave diameters: We must figure with the "pitch diameter" here, or the outside diameter of the pulley minus the depth of the belt. Nominal belt depths are $\frac{11}{32}$ of an inch for the A size, $\frac{7}{16}$ of an inch for the B, and $\frac{5}{8}$ of an inch for the C size. Suppose we have a drive sheave outside diameter of $4\frac{1}{2}$ inches with a B belt, and we want a step-up ratio of 1.29:1 on the driven sheave. What outside diameter should it be? First we subtract the B belt depth of $\frac{7}{16}$ of an inch— from $4\frac{1}{2}$, which gives $\frac{41}{16}$ of an inch. Then we divide this by 1.29, giving 31.15. We then add $\frac{7}{16}$ of an inch back on 3.15, and get 3.59—or roughly $3\frac{5}{8}$ inches— for outside diameter of the driven sheave. Clear as mud, eh?

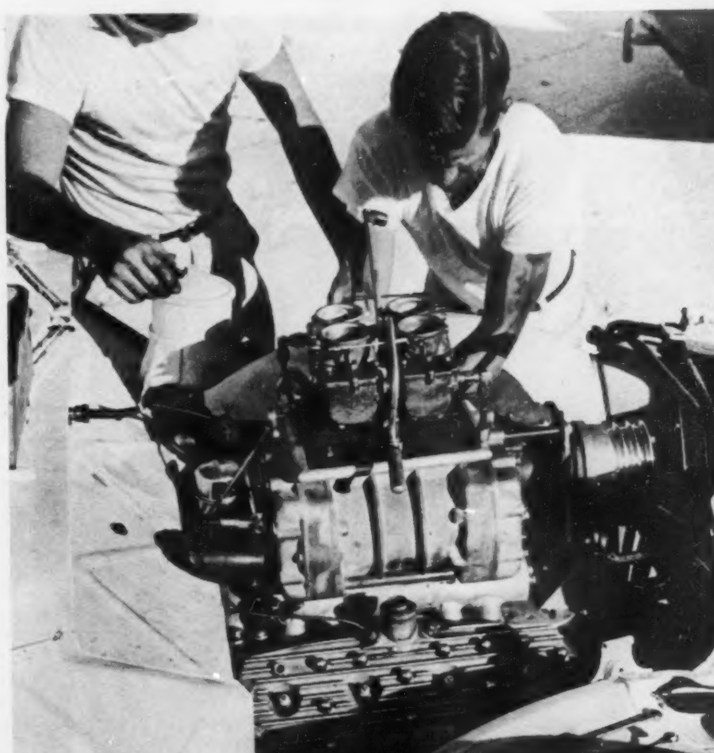
### TUNING FOR A SUPERCHARGER

The people who are really moving with blown cars these days have done considerably more than just bolt on a supercharger kit. This doesn't mean you have to go "full-house" on additional engine modifications—super awful-awful cam, sky-high compression, big bore and stroke, etc. But special attention to induction, carburetion, and ignition are necessary to get the most out of a standard bolt-on blower kit . . . and, of course, any additional modifying will make it go just that much better. Here are a few points you might consider.

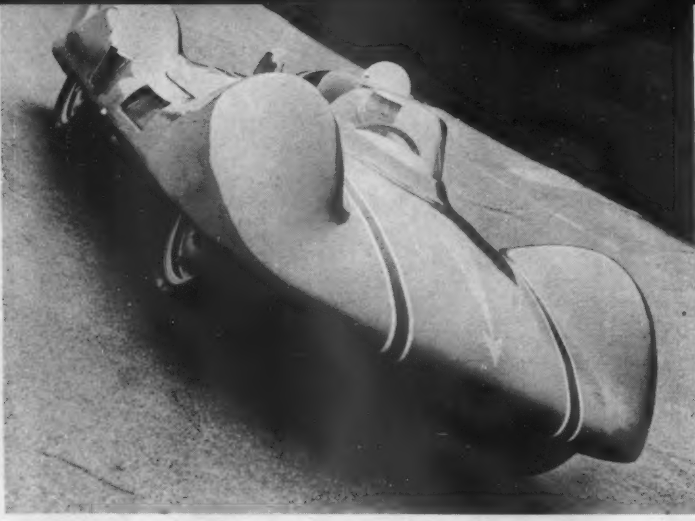
*(Continued on page 65)*



*Two-stage blown V12 Alfa. Blowers are gear driven from crankshaft. Enormous amount of carburetion is needed with this unit.*



*Four dual throat Stromberg 97 carburetors are used to pour fuel into GMC Roots-blown Foxx-Cobb flathead Merc for Bonneville.*

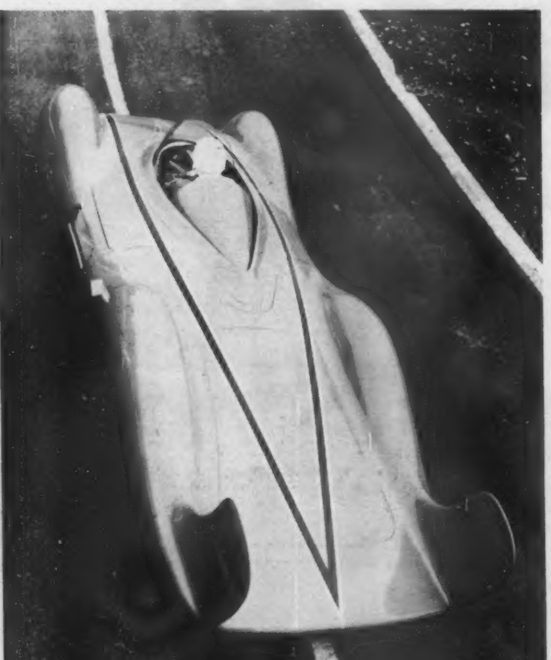


*Shooting Star takes a run on test track in France. Body for this Grand Prix prototype was designed by Eiffel laboratories, pioneers in aerodynamics.*

***The era of turbines for International racing may already be here. First on the line is Renault's***

# Shooting Star

*By KEN KINCAID*



*Fins on laminated "Disco" type body theoretically help directional stability.*

ALFRED NEUBAUER, Mercedes-Benz racing wizard, is as sharp as he needs to be. In a French magazine article published in November, 1950, he prophesied that race cars powered by gas turbine engines would begin to become forces to be reckoned with sometime in 1956. He advised French automobile manufacturers to start taking a closer look at their vigorous aircraft gas turbine industry. "Your position is fortunate," he said. "If you exploit it you will have a big advantage over race-car builders in other nations who will have to pay dearly for licenses to use turbines of foreign make."

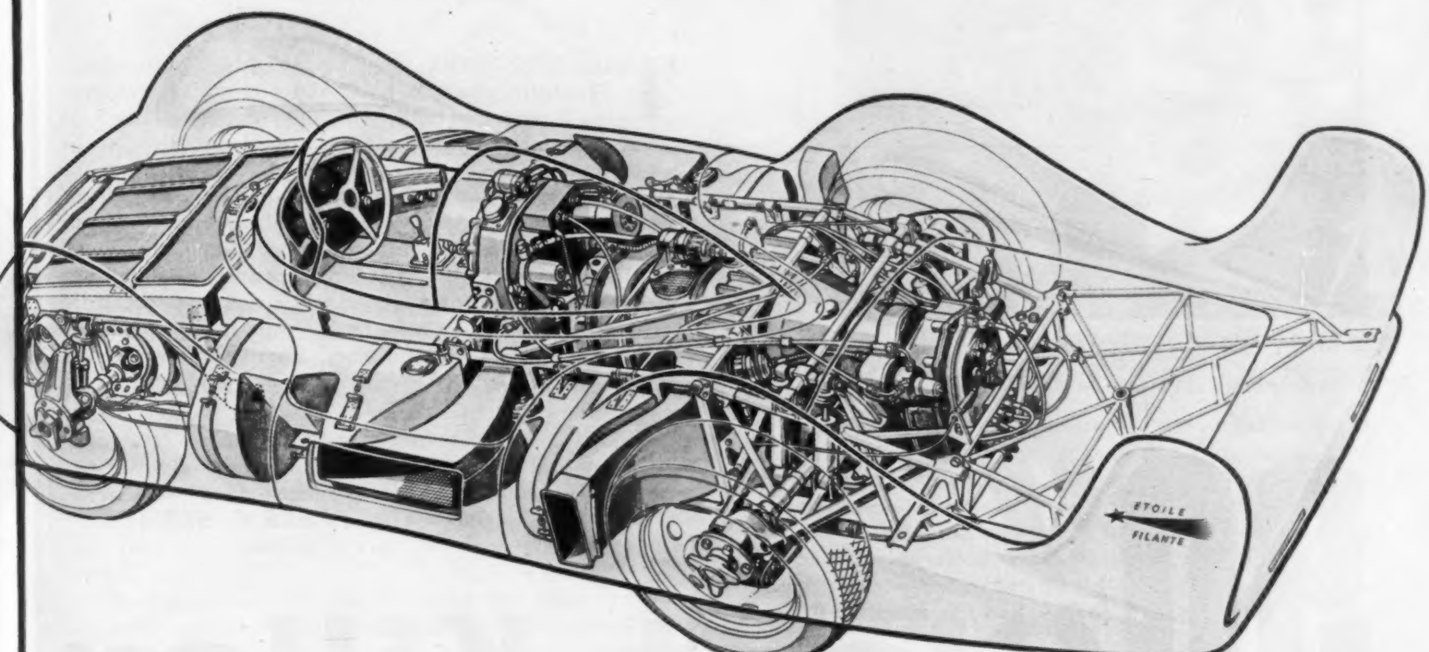
A few French ears were alert to this message, but the first well-financed and seriously engineered gas turbine grand prix prototype did not materialize until this year, proving the German's timetable accurate to an uncanny degree.

Existence of this new experimental turbo car was first revealed last June. It is, somewhat surprisingly, the baby of the French government-owned Regie Renault, one of the world's largest automobile manufacturers, but a firm that has taken no part in formula competition since the early years of the century.

Renault engineers' pride of authorship has not restrained them from drawing on the best talents and facilities that their country offers. They turned to one of France's most experienced producers of aircraft gas turbines, Turbomeca, for a power unit. For an ideal body they called on the Eiffel Laboratories, named for the tower-builder who was one of the world's great pioneers in aerodynamics. Leading French experts in the design of aircraft fuselage collaborated on the new car's space-type frame. The disc braking system and magnesium wheels with dural rims were contributed by Dunlop's factory in France.

Renault calls the experimental car *l'Etoile Filante* – the Shooting Star – but is so far keeping mum on its performance or just what the machine is intended to do or prove. But the makers do not hesitate to spell out its specifications in great detail. The *Etoile Filante* may well be racing history in the making; how it is made deserves to be recorded.

*Cutaway of Shooting Star shows space frame, 35,000 rpm power plant, twin shock absorbers, and front wheels universal jointed to inboard brakes.*



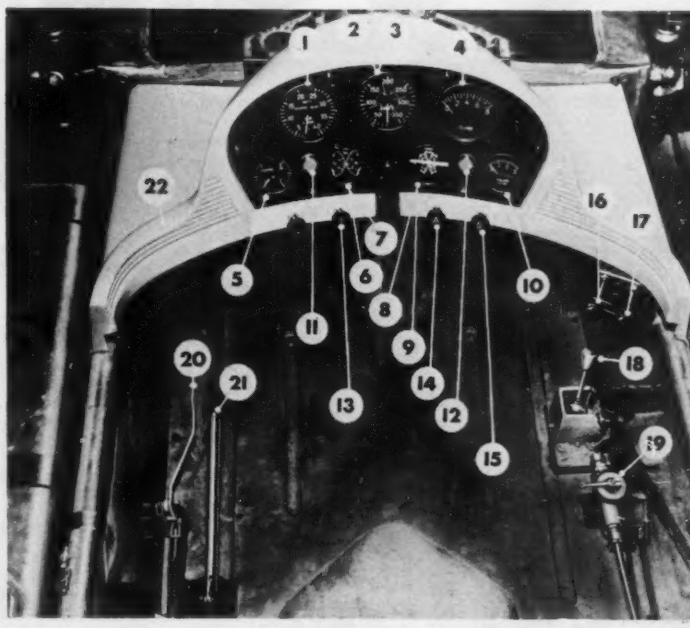

The power plant is of the free turbine type, in which there is no mechanical connection between the gasifier and driving turbines. The gasifier consists of a centrifugal compressor, a combustion chamber, a turbine wheel on the same shaft with the compressor, and a centrifugal fuel injection system. The mixture of kerosene and air is initially ignited by a spark plug, after which the combustion process is self-sustaining.

At 274 maximum bhp, the gasifier shaft turns at 35,000 rpm. The hot gas, the engine's working fluid, is ducted to the free, driving turbine which has a peak speed of 25,000 rpm. The bearings are lubricated by SAE 10 in a dry sump system.

With this turbine's full torque at stall, there is no need for a clutch or gearbox of the familiar sort. But there is a screaming need to whittle the driving turbine's incredible speed down to a useable 2,500 revs or so. This is accomplished by means of a three-stage reduction gear system which also includes a single reverse gear and a brake for halting the turbine wheel during gear changes from forward to reverse.

The power unit is mounted in the chassis on rubber blocks and the chassis frame is fabricated from chromemoly steel tubing. A form of swing-axle independent suspension is used at the rear, torsion bars provide the springing, and all four disc brakes are inboard-mounted and are sprung weight. The Shooting Star's body is formed of laminated polyester resin and its prominent rear fins are intended to aid in maintaining directional stability. This car undoubtedly inaugurates the era of turbines in grand prix racing, which may shape up faster than any one of us thinks, except, perhaps, a few men like Neubauer. #

| | |
|---|---|
| Tread, front & rear | 49.6 ins. |
| Wheelbase | 94.6 ins. |
| Length | 191.0 ins. |
| Height (top of windscreen) | 39.0 ins. |
| Weight, dry | 2090 lbs. |
| Pounds per bhp (dry) | 7.6 lbs. |




Controls:

1. Tach for gasifier.
2. Outer dial shows road speed up to 350 kph or 217 mph.
3. Inner dial shows driving turbine revs.
4. Gas temperature.
5. Air compressor pressure.
6. & 7. Oil pressure.
8. & 9. Oil temperature.
10. Driving turbine temperature.
11. Ignition light.
12. Starter light.
13. Instrument lights.
14. Coil switch.
15. Starter switch.
16. Fuel control.
17. Oil control.
18. Reverse gear lever.
19. Three-way fuel valve.
20. Brake for driving turbine.
21. Hand brake.
22. Instrument panel of laminated plastic.

*Tach below instrument panel, on left, was installed by Chuck Rhodes. Speedometer is marked in kilometers.*

THE TWO CARS lined up in the starting chute. The little white coupe looked diminutive and helpless beside the bulk and noise of the modified '53 Chev. The starter pointed his flag toward the driver in the white car and received a "ready" nod. The driver in the black coupe also nodded "ready." The flag went up and the air filled with the nervous high-pitched rapping of exhaust pipes as each driver raised his rpm level. The flag dropped and the two vehicles smoked off the starting line. The Chev hesitated a fraction of a second while one rear wheel did its best to melt the asphalt. By the time it took hold, the little white car was nearly a length ahead. The two wound out in low with the Chev gaining and finally heading up

# 90" Giant Killer

*By PETER G. SUKALAC*

*BMW and '53 Chevy step off the starting line on 1/4 mile strip. The 239 cubic inch, reworked Six lost out to the 90-incher in every gear.*

*Front view shows classic grille and fender line that has typified BMW since early thirties to present.*

nose to nose as the driver shifted to second gear—but, the little white jobby kept right on winding making a slight gain, then so quickly into second that only a change in engine note told the story. The Chev was abreast again when the driver dropped into top gear and really stood on it, too late—for the engine in the white car kept right on winding tighter and tighter. Again the two were abreast of each other, then the driver in the little car hit third and gradually, but definitely, started to pull the big black coupe. When the two flashed by the flagman at the end of the quarter mile, the small car was nearly a full length in the lead and the driver was given the nod. As the two cars idled back to the pits on the return strip, the announcer's voice boomed out over the excited babble created by several thousand spectators. "The winning car is a 1939 BMW featuring a destroked engine of 90 cu. inches, owned and driven by Chuck Rhodes of Eugene, Oregon. The 'lil fella just pulled a '53 Chev coupe powered by a modified 239 cu. inch mill running a cam, carburetion and reworked head."

Hard to believe? Yes, it is! There are few sports machines, or more correctly, sports tourers, that will stay with Detroit iron on their home gound, the 1/4 mile drag strip. With rare exception, the trophy winning drag car racer is loaded with gobs of torque as the direct result of a large bundle of displacement. Unless he likes being "wiped out" by less romantic iron the sports car enthusiast generally refuses to enter his pride and joy in such events. Rather he caters to the type of thing his machine was developed for, touring and an occasional rally or road race. Who, then, did this brash youngster think he was to put his head in the lion's mouth?

To begin at the beginning, Chuck Rhodes, a long time auto enthusiast, had a few years to put in for Uncle Sugar. Two of these were spent in Germany, Stuttgart, to be exact. Here young Charles put in his "on duty" hours barking knuckles on Air Force equipment while carrying out various T.O.'s as a mech. His off-duty hours were spent in circulating among the garages and dealers' shops to see just what was new or interesting in foreign iron. One day Chuck happened across a newly-rebuilt 1939 BMW cabriolet. The little coupe sported a neat six cylinder 1971 cc vertical valve mill that did a creditable job performance-wise. Liking the car's looks and handling, he tossed some marks in the owner's direction and returned to his barracks no longer a slave to the GI busses.

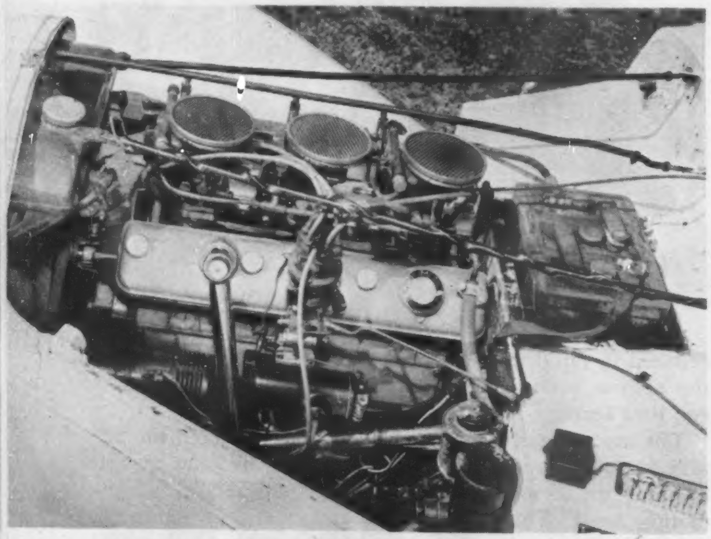
After driving the car for some time, Chuck felt that the car lacked the performance he needed if he were to stay with the cars his buddies drove at the various rallies and road events. The two litre engine put out but 60 hp, which, though given willingly, was hardly enough for street use, let alone sports events. Having heard about the type 328 head so popular on these cars before the War, Chuck set out to find a pre-war dealer who could help him find one of these overhead outfits. Perseverance pays off when scrounging parts in Germany, as well as in the old USA, for after a great amount of searching our lad found not only a head, but an entire mill. The mill was not stock, though, for it had been destroked by replacing the old factory piston and rod assembly with a kit built up by Veritas, a defunct hop-up shop previously located in Messkrish, Germany. The theory behind the building of the kit was twofold: first the 2.60 inch bore and 3.78 inch stroke of the two litre engine gave too high a piston speed which resulted in rapid wear and inherent unreliability; secondly, the engine, even at its best, was no match for the scarlet two litre Ferraris, Alfas, etc.

The deal sounded good to Chuck, and he pulled the 327 mill out of the coupe and replaced it with its hairy-chested brother, the 90 inch block, complete with type 328 monkey-motion head. The difference in power was pronounced, especially in third and top gear, and the mill was still smooth in operation. When the time came for Chuck to return to the States, he had driven the little jewel a total of 20,000 miles and had chalked up many a trophy win at various meets.

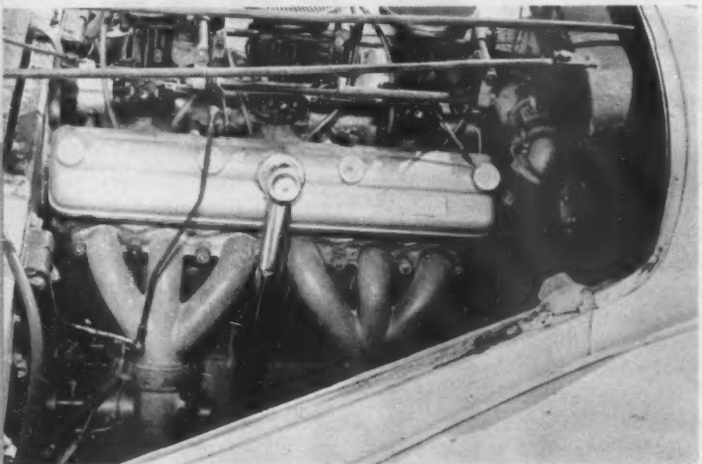
Back home in the fall of '55, Chuck picked up the November issue of SPORTS CARS ILLUSTRATED and read therein that the Bristol could be warmed over by a few basic modifications to the intake system and carburetors. Knowing of the similarity between the Bristol and the BMW engines, it seemed logical to him that the same modification should be applicable to the upper end of his 90 incher. The little mill had been experiencing extreme valve float at 5200 to 5400 rpm which limited the car's performance in gears. This was reason enough for an internal look. Besides, he had had a burning curiosity regarding the appearance of the Veritas-BMW set-up ever since he had installed the rig in Stuttgart.

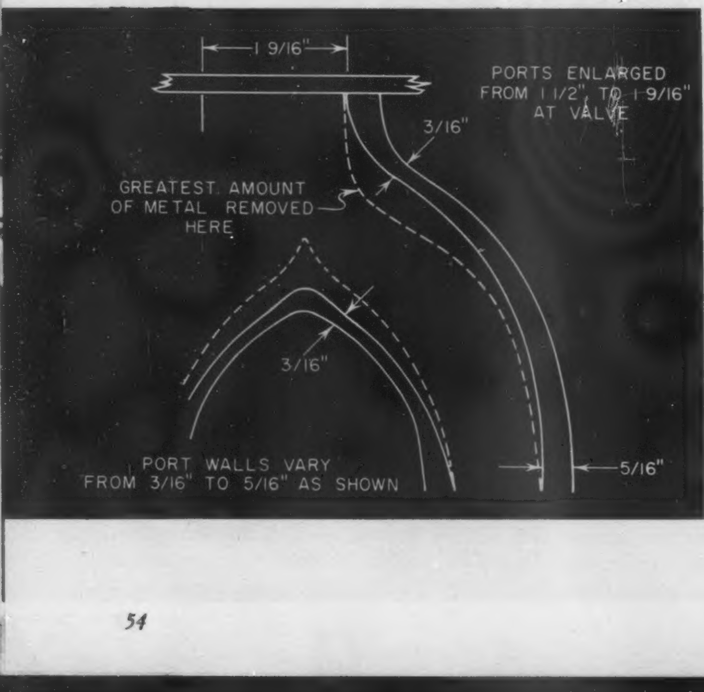
Without further ado, Chuck pulled the husky little rascal off its mounts and disassembled the head and dropped the pan. Valve timing on the engine was not known to him, so using a degree wheel he checked for this all important information fully expecting a "wild" layout. To his surprise the cam was mild, by modern standards, with the intake opening 4° BTC and closing 46° ABC, and the exhaust opening 44° BBC and closing 3° ATC. Total lift at the exhaust valve measured 7/16 of an inch and 5/16 of an inch at the intake. The valves were large for the small bore with the exhausts measuring 1 1/2 inches and the intake 1 9/16 inches. The bore measured 66mm and the stroke 72mm. This figured out to a capacity of 1478cc. Using the time tried oil and cc glass, Chuck checked the compression ratio, which measured out exactly at 8.5:1. Continuing the tear-down, the piston, rods and crank were all pulled and laid on the bench. The crank was stock and bore factory markings. The rods were of stock length but were polished and bore no markings. The pistons were likewise unmarked, but differed from the stock-type inasmuch as the pin bosses were closer to the crowns and the crowns themselves were raised for greater compression. Chuck boxed up the pistons, rods, the crank, flywheel and clutch assembly and sent the stuff to Portland, Oregon, for a complete balance job. Work was then begun on the head and intake system. According to the information on the Bristol, an easy 26 percent gain in performance could be had by removing a like amount of metal from the manifold and ports. Chuck measured the

*Souped 90 incher has modified porting system, light Bristol pushrods, 3 Solexes, Bosch distributor, DSM coil, Mallory condenser. Lever controls spark inside.*



*Exhaust system remains same. Twin headers flow into two exhaust pipes, meet at car's midpoint, form one tailpipe exhausting in front of right rear wheel.*






wall thickness of the intake passages and found the "meat" extremely thick. (See diagram) The next two weeks of his spare time was spent cleaning away the excess metal. The walls were reduced to approximately $\frac{3}{16}$ to $\frac{5}{16}$ of an inch, a total reduction of about 30 percent. Where metal could not be removed it was smoothed and all edges and corners removed. The head was then surfaced to make for a perfect gasket fit.

Attention was then turned to the valve train. The valves were lightened slightly by cutting and then polished. The major reason for the floating at 5200 rpm was apparent when the valve springs were checked—they were weak enough to be compressed by hand, even though they were of stock tension. The answer here then was the inclusion of an inner spring. Wayne Chevy inner springs were of the right diameter, but were too long. So, a set of these were shortened and installed. The addition of the inner springs increased the open tension by 50 pounds.

On examining the lifters and pushrods, Chuck noticed that they seemed quite heavy. He wrote to the Bristol parts house in Chicago, Illinois, and asked for a complete set of lifters and rods for the Bristol. When these arrived they were compared for length, diameter and weight. The Bristol parts were lighter. The exhaust lifters and pushrods were installed as-is, but it was necessary to shorten the intake rods $\frac{5}{32}$ of an inch and cups mounted in place of the original balls before these could be installed.

By this time the stuff from the machine hop had returned and Chuck began the careful job of reassembly. The ignition, consisting of a Bosch UK6R dual point battery-fed distributor was left as-is with a stock timing of 46° BTC. The three Solex pots, however, were given the treatment described in the article on warming a Bristol. The Type IF Solexes were reworked by enlarging the Venturis to $1\frac{5}{16}$ inches, and main jets to 112 x 58; the air bleeds in the discharge nozzles were drilled to .064. The discharge wells and correction jets were then smoothed and streamlined. As a final step the butterflies were thinned. The pots were then buttoned on and the completely rebuilt mill dropped on its mounts.

Out on the strip for a test run the newly run-in engine sounded healthy. The time on the standing quarter mile for the 2650 pound coupe was 76 mph; with a rolling start this jumped to nearly 86 mph. This with a road gear of 3.70. A measured mile was traversed, with a rolling start, at 103 mph. That's terrific performance for any car in the $1\frac{1}{2}$ litre class. This was one time when the old rule of the "most inches" didn't hold true. If any loss of performance resulted from the destroked engine, it was not apparent. Rhodes now winds this wee mill to 6000 rpm with safety, something that just wasn't done with the old long stroke engine. He also is able to hold the tach at 4700 rpm in top gear for long periods of time without heating and minus the roughness and vibration of the old 328 stroker. #

*Details of enlarging ports. Walls were reduced about 30%, which according to Bristol information netted a gain of 26% in flow performance.*

## 2.4 Jag

*(Continued from page 17)*

rear window looks narrow at a glance, but its generous width tells the whole story in the mirror, and the only snag in visibility is the old-fashioned width of all the body pillars.

Interior ventilation is easily regulated and draft-free, American-fashion, and the window winders have a ratio of one turn, top to bottom. Other fresh air can be scooped in at the cowl and either let in directly or sent through the heater, which has two outlets under the dash. The manual recommends the use of the heater blower under all circumstances, but forward ram action seems to shove air in pretty well when under way.

Interior room for the family is matched by the capacity of the trunk, which is cleanly laid out with the major jacking tools clipped well forward. The spare drops into a covered depression in the floor, next to the gas tank, and in its hub is stored a nicely fitted tool kit. That jack, by the way, is easy but infinitely boring to operate, since it's designed around an extremely shallow screw thread. Two Dzus fasteners under each rear door liberate the fender skirts.

An imaginative venture into integral construction yielded dividends to Jaguar in the form of a stiff, solid structure with minimum weight, and the few chances taken here were counterbalanced by the use of a much-reworked version of the well-tried series of six-cylinder engine. The old XK100 four was considered in the planning stages, but they wisely decided that the six would come closer to Jaguar standards of silence and smoothness. That the choice was good is reflected in SCI's upcoming Tech Report on this ruggedly precise powerplant, which reveals many of its potentialities even in humble 2.4 tune. Proper use of the Start control brings it to life instantly from cold, and the warm-up idle is smoothly inaudible. Accelerator pumps in the Solexes make up for the plumber's nightmare of manifolding to provide the instant throttle response that's expected in a Jag, and this rev-ready eagerness stays in there all the way to the top making you wish there weren't a peg on the tach. Within the visible range of figures there's no shadow of protest or vibration, and the red sector at 5500 is more for decoration than anything else. Peak power, after all, comes in at 5720!

*(Continued on page 56)*

*(Continued from page 55)*

We expected a hood full of revs, but we weren't prepared for unusually good low-speed torque for a 150-cubic-incher. A glance at the torque curve and its 2000 rpm peak told the story, though the 2.4's road behavior was more than convincing enough. It does like to wind, though, and it's a shame that the gearbox occasionally dampens its ardor. The cover of the basically standard Jaguar box has been redesigned to give a mechanically more direct lever control, which somehow manages to have a very vague and rubbery feel. It improves on acquaintance, but the pattern remains wide-spread and the knob still evades the wildly groping hand at crucial moments.

Jaguar's machinelike whine remains in the lower ratios, and is accompanied by slight dog clutch protest if the synchromesh is rushed at all. The indirect gearing is closer to that of the first XK's than it is to the close ratios used in the present 3.5 liter machines, and as a result you're all done a little sooner in the gears than you would like to be to use that engine to the full.

When you get on good terms with the gear train, the 2.4 responds with strong and steady acceleration that will carry it quickly to an easy cruising speed of 80 or so, which is still within the common piston speed limit of 2500 feet per minute. In its present trim, the 2.4 Jag is a nice balance between the paired factors of power and roadholding. The word now seems to be that the big 3.5 engine will find

*Kit has tools for minor services.*

its way under this hood for the American market, which will dump 51 more pounds where they aren't needed and apply more power when it can't be fully used. We'd much rather see this fascinating short-stroke six developed further, with perhaps an optional C-Type head and close-ratio gearbox if more suds are demanded. Those plus stiffer shocks all around would push the 2.4 over the line into the Gran Turismo class and enable it to surprise many a sport car. Even now it's one of the most satisfying small sedans around. — K.E.L.

# *Sussex Special*

*(Continued from page 27)*

amazing. Maximum speed of an 1172 cc Anglia sedan with twin carburetors, raised compression and so on, is around 95 mph, and reliability is not affected. The very first Anglia conversion was driven straight from the plant into the 1956 Monte Carlo Rally and finished the course after much ultra-high speed motoring, and with no bothers. Nichols also produces a similar F-head ioe (inlet over exhaust) for the earlier Ford Eight/Ten engines of identical capacity, and these are called L.R.G. heads, after his other business, London Road Garage.

## INTAKE

Power output of the Ford-Elva engine is 65 bhp at 5700 rpm on a 8.9 to one compression ratio and with two 1½ inch S.U. carbureters. A sports camshaft is also employed to gain these figures, and the Elva Engineering Company can supply similar camshafts if the customer so desires.

When it is pointed out that Harry Weslake, gas-flow expert and designer of porting and combustion-chambers on all Jaguar engines, has given a great deal of his time and attention to the Elva head shape, it is not surprising to learn that the engine has an exceptional power curve. Maximum torque is produced at 4500 rpm, but the curve is flat enough to maintain most of it through the greater part of the rev-range. The head is of a light alloy with the overhead intake valves operated by pushrods and rockers from a normally-positioned single camshaft which also actuates the side exhaust valves. Oil is supplied under pressure to the rocker gear through a ⅛-inch copper pipe attached to the main oil gallery. The intake valves seat on Bimetal cast iron inserts which are positioned directly above the pistons.

Combustion space is over the exhaust


*This Sussex special is equipped with more expensive Coventry-Climax mill.*

valve and a 10 mm spark plug is fitted in this area. A useful feature which has a great sales appeal to keen owners of normal English Fords is the use of "drop-in" inserts for the redundant intake valve seat in the cylinder-block. The inserts are ready-machined and require only a light grind with carborundum paste to effectively seal off the port. Centers of the inserts are drilled for the new pushrods to pass through, and complete conversion to overhead valves takes only about three hours. Ford exhaust valves of standard type are retained.

The latest works Elva is fitted with one of these ice power-units, but it has an even hotter specification than the "standard" engine and is now developing 83 bhp at 5800 rpm with four Amal motor-cycle carburetors. Nichols' scheme is to use his works car as an experimental machine with which to try out new ideas which may possibly be embodied in next year's Elvas. With this plan in mind, he had equipped the new car with an even lighter frame and front suspension, rack and pinion steering gear and a De Dion type suspension layout at the rear.

### REAR END

He and "Mac" Witts have arranged the rear-end so that should it eventually become a standard Elva fitting, existing cars with Ford back axles can be converted by bolting the De Dion arrangement on with virtually no modification. The same coil springs and telescopic dampers are used, and the final-drive unit which is rigidly attached to the frame, is a cut-down and modified Ford component. The works car has a single transverse disc-brake, hydraulically-operated, and fitted to the rear of the differential casing where it provides all rear wheel braking. This feature reduces unsprung weight to the minimum and should also improve the already noteworthy roadholding. In addition, it substantially reduces wheelspin under fierce acceleration due to the two short universally-jointed half-shafts being unaffected by torque as with a "live" axle. It should be stressed, however, that the whole car is experimental and that only the features which prove themselves satisfactory under racing conditions will find their way into the specification of the 1957 Elva.

Many new Elvas are to be seen on British circuits this year and several are being exported to Canada. As this article is being written, an Elva-Climax is on its way to a new owner, Charles Dietrich of Sandusky, Ohio, who should be seen in competition before long. At around 2600 dollars complete, it will be surprising if a good many more of these potent little sports cars do not find their way across the Atlantic. #

## Dauphine

(Continued from page 31)

One of the big factors in the Dauphine's excellent showing in the Mille Miglia had to be its brakes. Based on the ready-to-go weight of our test car, these brakes offered 194 sq. ins. of lining area per ton, a rather fantastically high figure. They naturally produce terrific stopping distances. During our standard fade test, which consists of ten successive emergency stops from 50 mph, they faded only slightly. In most cases, the time required to get back to 50 mph after a test stop was enough to bring the brakes back to their original retarding power. Although pedal travel was almost entirely used up by the tenth stop, the car's braking distances were exactly as good as they had been originally.

### ENGINE

With hardly any use of light alloys, the Dauphine still is a very light automobile. But it isn't light enough to give it the kind of power-to-weight ratio that would lead you to expect gutty performance. What it does it does by virtue of sheer ingenious design. Its tiny water-cooled, in-line four-cylinder engine will not force the textbooks to be rewritten, but it is nevertheless representative of the very best in conventional modern engine practice. Short and rigidly made, it can get all the reliability from its three main

*Model in cutaway Dauphine shows car roominess despite small outward size.*

bearings that other engines might derive from five. The camshaft is located as high as possible in the block, to permit short pushrods and minimal reciprocating weight in the value train. The head is a well water-jacketed light alloy casting with shrunk-in valve seats. Among the most significant details are the wet cylinder liners, water jacketed throughout their length. They're long-wearing to start with and can be replaced over and over again, giving the engine a Methuselan life expectancy. From the standpoint of service accessibility, the Dauphine engine is second to none, and the low cost of a ring and valve job is a downright joke.

### GEARBOX

Coupled to the forward, flywheel-end of the engine is the combined transmission and final-drive housing. The shift mechanism follows the familiar American three-speed pattern and the synchromesh on the top two ratios (top is also indirect) is absolutely unbeatable. You can slash the shift lever up and down as fast as you please, and you can't outwit the synchro — it's completely positive and instantly effective. The shift lever itself is on the flaccid side for sure; even when engaged in a gear the lever can be sloshed around loosely. This is not compatible with the usual concepts of perfection, but it works perfectly well and we learned to live with it during the first 15 minutes in the car, just as we learned to evade the lever's tendency to snap at the hand that guides it as soon as the clutch is let out.

The lever, furthermore, is several inches too short. Unless you are very tall or have the arms of an anthropoid you have to bend forward every time you shift. And some people who have driven the Dauphine complain that the brake and clutch pedals are too close together for comfort. However, owners who would like to see these details modified are free to have an offset welded to the clutch pedal and a longer shift lever installed. This custom tailoring should cost less than $5.

### CLUTCH

The clutch pedal can be dispensed with entirely at a cost of $100, the price of the Ferlec electromagnetic automatic clutch. We have driven a 4CV so equipped and can vouch for the convenience that the Ferlec clutch provides. It is subject to two forms of control, generator output and pressure on the shift lever. You can leave the lever in gear at idling speeds, then step on the throttle, and the clutch engages when the generator cuts in. When you're under way, you have only to touch the shift lever to cause the clutch to disengage. You learn to remove your hand entirely from the lever before applying throttle; if you don't, the clutch will remain disengaged and you'll just race the engine. With a little practice this becomes a welcome accessory for drivers of the shiftless sort.

The Dauphine's front suspension is

of conventional coil spring and wishbone type, and the rear suspension is the simplest of swing-axle independent layouts. But it's rugged, it provides terrific road adhesion, and needle-bearing trunnions nail axle torque right at the inboard U-joints. Changes in passenger load — and, consequently, in rear-wheel camber — have no observable effect on the car's handling qualities.

In terms of basic lines and finish, the Dauphine is an attractive and appealing car, with nothing in its overall look to type it as a rear-engine machine. The Cadillac-style air intakes on the rear fenders are realies rather than falsies. The recessed part of the body that blends into them was added to the original design when it was found that the body aerodynamics were "too good"—that more air flowed past the intakes than into them. The intakes feed cool air to the radiator and then to the engine; the air is finally discharged through louvers at the rear of the body.

### APPOINTMENTS

Unlike most rear-engine cars, the Dauphine is notable for near-total lack of engine noise in the passenger space. Only when you wind the engine tight are the rear-seat riders likely to remember that they're sitting next door to the engine room. An extremely simple but adequate system of hot-air ducts warms the passenger space and supplies the defrosting slots, and Dauphines for the U. S. export market come equipped with a blower to boost the circulation of warm air. An admirable detail is the location of the six-volt battery. This vital but often abused component sits in the luggage compartment, far from the destructive heat of the engine.

Operating economy is, of course, one of any light car's main reasons for being. We expected good fuel consumption in the Dauphine, but what we actually got was startling. The very worst gas mileage figures, taken during acceleration and top speed runs, was 36.5 mpg. During average around-town driving we recorded 41.3 mpg and at a steady 40 mph we got just under 50 mpg!

For running economy — as well as space, performance, roadholding, comfort, silence and braking — the Dauphine is a supremely satisfying light car and it stands among the leaders in its field. In spite of the metallic resonance when you shut the doors, the car sounds and is strong, solid and well-knit in every other way. And it's a real ball to drive. #

## *Fireball Flathead*

*(Continued from page 37)*

split fabricated box section. This box section, roughly the shape of a boomerang, carries the double tube radius rod on its front half and the spring shackle attachment on its rear half. This leaves the rear axle independent of chassis roll. The transverse rear spring is located quite high in order to clear the quick change unit. Since some of the disadvantages of a short wheel base can be alleviated by using a longer spring base, the builders hung the spring as far as possible behind the axle center. Gabriel Ajust-O-Matic shocks are used in the rear and seem adequate for the job. A limited slip differential unit is fitted. Final drive ratios with the Halibrand-Ford set-up are almost infinite, making it well worth whatever trouble it is to install.

The brakes are pre-1949 Ford-Bendix units. In the front the steering arm location limits the drum diameter to ten inches, the shoes are 2.50 inch wide shoes. In the rear the drum diameter is 11 inches with 2.50 inch wide shoes. The drums are liberally drilled and arrangements are made to duct cooling air directly to them. The master cylinder is located on the firewall and is directly actuated by a pendant type lever. The hand brake operates by cable on the rear wheels only.

The gearbox is a center shift Ford unit incorporating Zephyr gears. Trautman feels that the low all-up weight of the car has had a great deal to do with the dependable service they have gotten from this unit. The plans for a new power plant include the installation of a Jaguar four speed box.

The clutch, a Ray Brown Friction Master, is hydraulically operated. The master cylinder is located on the firewall adjacent to the brake cylinder and is also actuated directly on the clutch ross shaft lever. Hydraulically operated clutches are sometimes heavy in use, but have a nice feel and the simplicity of layout can save a builder a lot of headaches.

The instrument panel is simple but adequate. It includes an electric tachometer, oil pressure, water temperature and fuel pressure gauges. The steel spoked wheel has a rubber rim and is installed at the typical speedway angle of 42 degrees. The two bucket seats have the sort of leather upholstery job that is seldom seen outside of a classic car.

The sight of a flat-head engine under the hood of a competition car these days is pretty startling — something like Bermuda shorts and high button shoes. But the way this car gets down the chutes *and* accelerates, you'd think that overheads were just a fad.

The reliability of this mill borders on the fantastic. It seems as though it hasn't been apart for so long that no one can remember what's in it.

The block is Ford and is bored to $3\frac{5}{16}$ inches and in company with a stroked crank ($4\frac{1}{8}$ inches), the displacement adds up to 283 cubic inches. The camshaft is a Russ Garnet regrind, but there are no available records of the timing. The tappets are the adjustable type and lift stock intake and exhaust valves. The intake and exhaust ports are "just polished." Pistons are Forged True's. The heads are Edelbrock's. A Navarro intake manifold carries three Stromberg 97 carburetors; a Bendix electric pump delivers the fuel. Sparks are supplied by a Joe Hunt Scintilla magneto and the plugs used are H-10's.

The radiator is a late model Mercury unit cut to the desired dimensions. Rubber-mounted, it is located well in front of the axle centers.

The envelope type body features some of the finest panel beating that ever turned up at a road race. Made of .064 aluminum stock, a close inspection didn't turn up any evidence that it had ever cracked or been repaired. The general shape of the body is simple, probably because the builders thought it's the way a racing car should be. Individual panels are numerous, nine in all that are quickly removable via Dzus fasteners. The nose piece carries the grill and covers the front wheels. The separate hood panel and two engine side panels makes it possible to get at the engine compartment quickly without removing the nose piece. On the driver's side the cockpit panel is removable; on the passenger side hangs a door that those harassed gentlemen at Le Mans would be delighted to see. Cross-braced with an adequate lock and hinges, it feels solid enough to swing on. The tail section is solid from the rear of the cockpit back and covers the spare tire that is carried directly above the differential.

This car has been in competition almost four years, proof in itself that it wasn't built in the woods by squirrels. You can name a half of million dollars worth of imported machines that have been raced into worn out hulks in this length of time. It's interesting also that the best cars of two years ago would not be able to stay with this car today. #

## *Minor Modification*

*(Continued from page 41)*

The carburetors were mounted on the intake manifold and the fuel lines connected. We also changed the contact points in the S.U. electric fuel pump, just to be sure of getting an adequate supply of go-juice. A neat, ball-joint twin-carb linkage was now fabricated and attached to the head atop the mounting bracket originally intended to support the carburetor air cleaner. No air cleaners were fitted, though these may be found necessary eventually.

### FINAL TOUCHES

Since there are no provisions on the Alta head for either a heater or water temperature gauge attachment, the water outlet was tapped for a heater pipe and the radiator tank was drilled to accept the end of the cable leading to the temp gauge. We can understand that there is no need for a heater in a car intended primarily for racing, but the absence of a temperature gauge tap seems pretty foolish. But all's well that ends well.

This ended fine. The car was now ready for a short test run. It started with a muffled but impressive roar and warmed up quickly. During the 10-mile test drive, it took great concentration and restraint on the part of the driver to hold the revs down below 3,000. Finally and reluctantly, the car was brought in and allowed to cool off. Then the head, tappet cover and exhaust flanges were carefully retightened, the carburetors properly tuned and the new rocker clearances set at .015 inch.

Except for a final check and additional tightening a week later, the job was completed. Total costs for parts and labor came to about $350, including $140 for the Alta head, a duplicate of which may be purchased from Alta Car and Engineering Co., Fuller's Way, Kingston Bypass, Surbiton, England.

### RESULTS

We found the expense to be well worth it. Fortunately we already had a heavy-duty clutch and Fren-Do brake linings in the car and didn't have to go into hock to put on these finishing touches. But we wouldn't even have minded the additional expense, at that, because the whole character of the automobile has changed. Cornering is now even better than before, thanks to the new horsepower, now in the neighborhood of 60, believe it or not. Gear shifting has been cut in half in city and normal country driving, and hill climbing has become a pleasure instead of a terror. The engine will rev to 6,900 rpm and can pull better than 5,500 in high. Performance is so much improved that it is almost unbelievable, especially since the whole car is also smoother than ever before. Compression ratio is up from 6.6 to 8.25 to one.

Acceleration runs produced the following results: Zero to 30 in five seconds flat; zero to 40 in 7.2; zero to 50 in 10.4; from a standing start to 60 mph in just 14.7 seconds; zero to 70 in 24.9 and a standing quarter mile in 19.9 seconds. Top speed came to 84.3 mph, and we believe this figure might well be exceeded by one crueler than myself, especially with more miles on the rebuilt engine.

From any standpoint this is a lot of go per dollar. We have even found that in average driving the gas mileage has gone up, not down, by two or three miles per gallon. Starting from scratch you could buy a used Minor and build a machine equivalent to this for way under $1,000. What are you waiting for? #

## *Le Mans*

*(Continued from page 45)*

impossible. Phone rings constantly. Public address system blares endlessly in French and English. Grandstands almost empty now. Overall leaders: 1. Flockhard-Sanderson; 2. Moss-Collins; 3. Gendebien-Trintignant Ferrari. Hawthorn-Bueb Jag has moved back to 20th place, going like a bomb.

SUNDAY, JULY 29 – 3:40 am: Ed coming in. Rain tapering off and course drying. Again stand ready on pit counter but gas hose won't pump. Cooper blows his stack while a kink is unravelled. Still no gas. Someone shut off the valve! Take in 63 liters and 2 pints of engine oil. Check gearbox. Car looks as though plunged in bath of muddy water, but tires still perfect. We are not 12th overall. Away after 4:17 pit stop that should have been 2:17 but for those seals. In the Esses, second wreck has joined Talbot. No. 18 Frazer-Nash spun and hit Talbot around 2 am. Car runs fine but can no longer get 6,000 on Mulsanne. Limit is 5,800. Valve springs getting tired. Dead dog on road halfway down Mulsanne. At Mulsanne pit our boys still there, pale but on job with board. Wave to them. Next lap—what's this? No. 35 Lotus lies broadside and battered on shoulder of second bend in Esses. Another spin. Only one rival left?

4:00 am: Halfway mark. This could be finish at Sebring, but here we're just getting second breath. It's lonely on Mulsanne with only cockpit light to keep you company. Check gauges; temperature 68° C; oil pressure 70 psi. Everything fine. Rain has stopped. Already, 27 cars out of race, but this stint I'm out for 44 laps. That's over 365 miles. Through Esses, more trouble. Yellow light blink warning. Porsche No. 34 of Bourel and Slotine, our pit neighbors, has spun out. Though slow, this 1300 stock Super coupe has gone well. Hope he restarts. Two laps later he is gone. No. 35 Porsche coupe of Frankenberg and von Trips passes me coming out of Terte Rouge; tremendous acceleration. Can't stay with him though I wind to 7,200 in second. Ding-dong scrap between Flockhart-Sanderson Jag and Moss-Collins Aston. Believe Moss now leads by scant margin. Drivers very polite. Each time I wave them by they acknowledge "Thank you" by raising right hand.

5:00 am: Dawn breaking at last. Swarms of gendarmes marching along Mulsanne to appointed posts. Patient, ghost-like crowds already packed three deep behind bulwarks through Esses and Tertre Rouge, at Mulsanne, Indianapolis and Arnage. Sarthe Circuit's 8.3 miles resemble junkyard with battered machines scattered all way around. No. 35 Lotus pushed to shoulder of road on Mulsanne. Also Frere's Jaguar. Further along, a DB-Panhard, Gordini and Porsche Spyder line road either side. At Mulsanne Corner, yellow Ferrari No. 20 (De Changy-Bianchi) which flipped earlier through steering failure while leading two-liter class, lies on right shoulder. At No. 1 marker, Mulsanne Corner, go to dump Cooper into second when gear lever knob comes off in my hand. Use escape road and do orbit. Our crew grins and waves. Well, the best of them have done the same: Moss, the Jags, many others! On lap 151 with ten to go and course wet only in patches, open taps wider. 5:22 says our board; 5:20.1 – finally 5:13.2, about 93 mph. At 7 am it starts drizzling again. Indianapolis banked turn skittish. A shade too much gas in second and tail wiggles. Watch it.

7:35 am: In for refuel in a downpour. Walker's Aston zooms by and seconds later crashes badly at Dunlop Bridge Curve. Bill Lamb figured this one pretty close. Tanks hold 70 liters and we take in 68! Only a little over half a gallon left. "I was worrying about the gas," I tell Bill, but he only smiles. "With three extra teacups full you could have done three more laps," he says. John Cooper and I exchange glances. Bill is an emotionless calculating machine. Nothing phases him. Upstairs on terrace above our pit, Desmond Titterington and a bunch of the boys are jack-knifed over parapet, rooting for us. Poor Desmond lost his ride when Frère crashed. Phil Hill also came by while I was out. Too bad his Ferrari quit in early hours. We've been leading Bicknell-Jopp Lotus for 10 hours . . . since last night at 11 pm. On Index we're sixth; overall, 10th. Ed is away in 3:38; all okay. We have almost a lap on Lotus.

9:41 am: Ed doing fine job circulating Cooper. Whittled lap time down to 5:13.1 when phone rings on lap 184. P. D. from Mulsanne: "Ed just signed to us his oil pressure's gone!" "Slow him down," Cooper barks. "He's got 12 more laps to do." Climb pit counter to watch for No. 33. Soon, blue and white car streaks up pit straight, sounding healthy as ever. Ed gives no sign. "5:22.7," Joan calls out. "He hasn't slowed much." We're all trying to figure out the trouble. A bearing? Loose oil line? Faulty gauge? If the gallant little engine quits now—it doesn't bear think-

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ing about. Cooper is[illegible]o alarmed. "He's probably low on oil and it shows up at the corners." Nonetheless, I run upstairs to Lucas' booth locate Windsor Smith, chief engineer of Coventry-Climax. We may need advice. For six more laps the Cooper continues running evenly. No expensive noises. Far from slowing, Ed does 190th lap in 5:19. We're breathing again when that ominous phone rings. Stan Nowak. "It's not oil pressure but the brakes. He just indicated it as he went by." Ed's time shows it. On lap 191 he takes 6:02.4; next lap he pulls in unexpectedly. "No brake pedal," he shouts to Cooper. "Nearly pranged it!" John shakes his head. "You've still got four to go for the minimum 34 laps. Cruise around and use the box." Ed is off in 27 seconds but Lotus is closing in fast. Too fast for comfort.

**11:05 am:** Car in. Fractured brake line to left rear wheel. No spare. No hammer, either. Cooper grabs spare generator and flattens broken pipe, sealing it off while "Court" rips up floor panel and refills empty brake fluid container. Brake pedal firm again. Gas: 49 liters; half gallon of oil, (we *were* low). Fuel consumption, 26.4 mpg. Takes 7:15 before I pull out. "Watch it on right-hand corners!" Cooper yells. Lotus now leads us by nearly a lap but I'm taking no chances until I feel out the brakes. Better second spot than smash-up after coming so far. Gear lever handle gone but manage first lap in 5:28.5 and brakes held, but shudder badly. Right-handed Mulsanne and Arnage are danger spots with only three drums working. As confidence returns and busted line still holds, time drops to 5:13.5, lap 214. Regaining three to five seconds a lap on Jopp in Lotus. Might still do it. But at 1:30 pm Jopp called in and replaced by works driver Reg Bicknell. Catch Bicknell at Tertre Rouge about lap 218. Unscheduled stop has reduced Lotus lead to 3:37. Due for disappointment, though. Along Mulsanne, Lotus pulls away and at Mulsanne Corner is 100 yards ahead. Try every trick, cutting off later, revving to 7,500 through gears and taking White House at 5,200 (114 mph) but nothing helps. Sad sight of Talbot No. 17 abandoned at Arnage is counteracted by smiles of pretty French girls who wave—but I can't do a thing about the Lotus. Lap times shrink from 5:13 to a steady 5:08 (nearly 95 mph) but best I can do is lock gap between us. Can't gain a yard. Bicknell must be winding near 8,000 to hold this average. Wonder if he can last? Lap 233, with one to go to refuel, see Lotus in pit, gassing up. Wish our tanks held few more liters. We might just make it without another stop.

**2:28 pm:** In for last time. Take in 61 liters in 2:21 – our fastest stop. Ed off in a hurry. Grandstands now a sea of heads. Leaders: Flockhart-Sanderson, Moss-Collins, Gendebien-Trintignant. Hawthorn-Bueb Jag has climbed back to sixth place. We're 9th overall; 6th on Index. Cooper sounds crisp as ever though unbelievably dirty in belated sunshine. Lotus now has one lap plus 1:28 on us, but anything can happen with 1½ hours to go.

**3:35 pm:** It *has* happened! Lotus in pit. Our crew in uproar. Friendly scout reports Lotus generator hanging by shred of one bolt. Bracket fractured. Cooper calls Mulsanne. "Tell our bloke to GO!" Ed responds at once but Lotus crew decides to gamble on generator holding fast for last few laps. No. 36 quickly pulls out. We're now less than a lap behind. Bicknell tails Ed by 7 seconds, but despite everything our "bloke" can do, Lotus closes gap and on lap 250 passes Cooper, restoring full lap lead. "Just one of those things!" somebody intones. We're feeling pretty good, despite 32 hours without sleep. Unfortunate retirement at 2 pm of the Brooks-Parnell Aston-Martin at Mulsanne has moved us up another notch, both on Index and overall.


**4:04 pm:** (approx) Ed gets checkered flag. *C'est finis!* Everyone in pit jubilant. We've lasted 24 hours on our first try and we're the only American drivers to finish. The game little Cooper covered 2,102.58 miles at an average of 87.6 mph including all stops. We're fifth on Index, ahead of three D-Jaguars (including the winners,) the Moss-Collins Aston, the Gendebien-Trintignant Ferrari and the Bourillot-Peroud 1½ liter Maserati. Overall we're eighth, nearly 56 miles ahead of the Maserati. As for Class G, the Lotus beat us by only 8.8 miles and had to put in crack factory driver Bicknell to do it. Anyway we held class lead for 12 hours out of 24 and *if* that brake line hadn't busted, *if* we hadn't wasted a good 12 minutes when refueling, due to those gas seals . . . Who cares? Bicknell is a great sport. John Cooper a wonderful crew chief. All our pit crew gave us magnificent, tireless support. We'll be back next year with bells on! #

## *Supercharging*

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CARBURETION: — A lot of auto enthusiasts seem to have the idea that a blower will compensate for inadequate carburetor capacity. It won't. Whenever air flows through a carburetor, there is a definite drop in pressure, the amount depending largely on the total cross-sectional area of the venturi throats and the air flow rate, in lbs., per minute. It is immaterial whether you've got a supercharger in the line or not. For instance, at an air flow rate of, say 30 lbs. per minute—equivalent to about 240 hp—an average-size four-barrel will drop five lbs. In other words, if we hitched a supercharger in the air line pumping five lbs. positive pressure at 30 lbs./min. air flow, the effective pressure in the intake manifold would be 3½ lbs. with the four-barrel and zero with the two-barrel.

The best way you can help a supercharger to do its job is to add carburetor venturi area. The goin'-est blown T-bird I ever saw had a hand-built collector chamber for three Holley two-barrels on an Edelbrock manifold (McCulloch blower). Beautiful!

CAMSHAFT—I believe in a hot cam with a blower. Road tests indicate that a special camshaft will give about the same percentage increase in horsepower and torque with a blower as with an equivalent raise in compression. But don't go too wild on the grind; a ¾ or "full-race" road grind works very nicely. Some cam companies can supply special supercharger grinds, with short overlap and early exhaust opening.

PORTING — Any trick that will reduce induction air flow losses is going to show up especially well with a blower, simply because air flow rates are so much higher than stock. Opened-up and polished ports, large valves, and bored-out ports under the valve seats (with the seat much narrower) are very effective.

COMPRESSION RATIO — Here is one spot where we've got to go very easy. In terms of cylinder pressures and temperatures at full throttle, a boost pressure of six lbs. is equivalent to a raise in compression ratio of approximately two full ratios—or, say, from 8½:1 to 10½:1. This is with a centrifugal or vane blower; a Roots would be even worse. Most supercharger experts don't like to think about ratios above 8½:1 on 90-95 octane pump gas with five lbs. boost or so. And with

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Detroit stuff crowding the 10:1 mark these days, this aspect is apt to be a serious problem in the future with manufacturers of bolt-on blower kits.

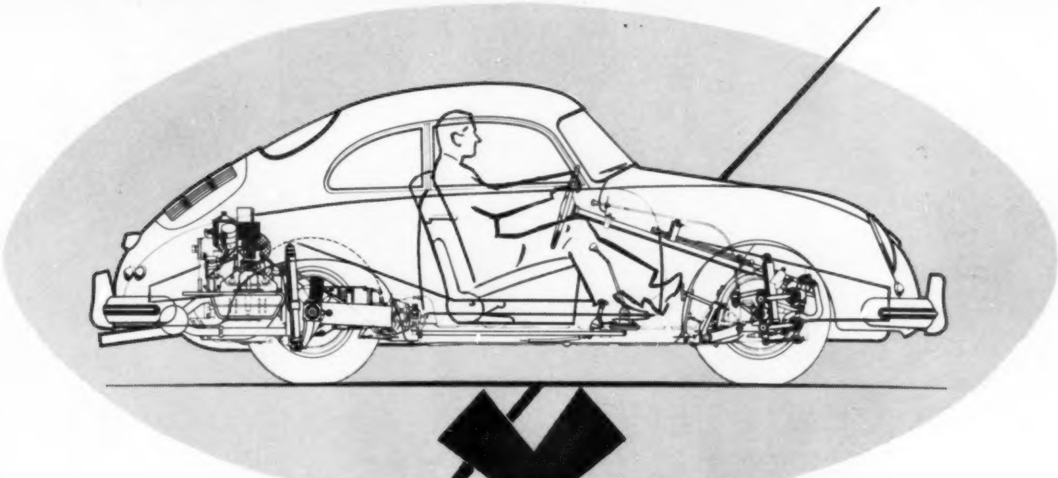
And that brings up another point...

SPARK ADVANCE – To get the most out of a blown engine, you need a spark advance curve that's tailored to the boost pressure curve. Your stock advance curve just won't do the job. Generally you don't get enough advance at the low end, 'way too much at medium speeds, and either too much or not enough at the top end. A number of ignition specialty houses (Mallory, Spalding, Jackson, etc.) supply complete single or dual-coil distributors for most cars, with advance curve available that are tailored to any type of supercharging. I can't recommend these "custom" ignitions highly enough. They're the perfect answer.

PLUGS – We're asking almost the impossible from our spark plugs when we expect long, trouble-free service with a supercharger. The range in cylinder temperatures and pressures between low-speed cruising around town and full-throtttle high-rpm acceleration on the highway is just too much even for a modern spark plug. If you choose a heat range that won't foul at low speed, it'll cook at the top end. A cold plug for happy highway performance will foul badly around town. It's either this–and a lot of popping and missing when you step on it–or very short plug life if you drive hard.

BORE AND STROKE–There is no substitute for cubic inches . . . and there's nothing in the theory of supercharging to change that idea. The more the better. The Europeans have always had a lot of fun–and done some wonderful things – with tiny sewing-machine-size engines boosted to fantastic pressures to achieve maximum power with minimum weight. Frankly, I like mine real big and hairy to begin with–and then I'll add some boost after that! One word of caution to the big-inch man, though: Large-displacement engines pull very high air flow rates from moderate-size centrifugal superchargers (like the McCulloch), which skyrockets the horsepower transmitted through the blower drive. Remember, boost pressure and impeller rpm are no reliable indication of this power consumption. It's easy to burn up a blower drive trying to keep up with the air demand of a big engine.

That pretty well covers the current picture in the supercharging field. Pressure induction can do big things for you –in fact, it's the only path to "ultimate" performance . . . but just remember that it wants a little babying and a little understanding. Coming up next–the newest thing in supercharging. #



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